MARCH 1956 2/6

Business

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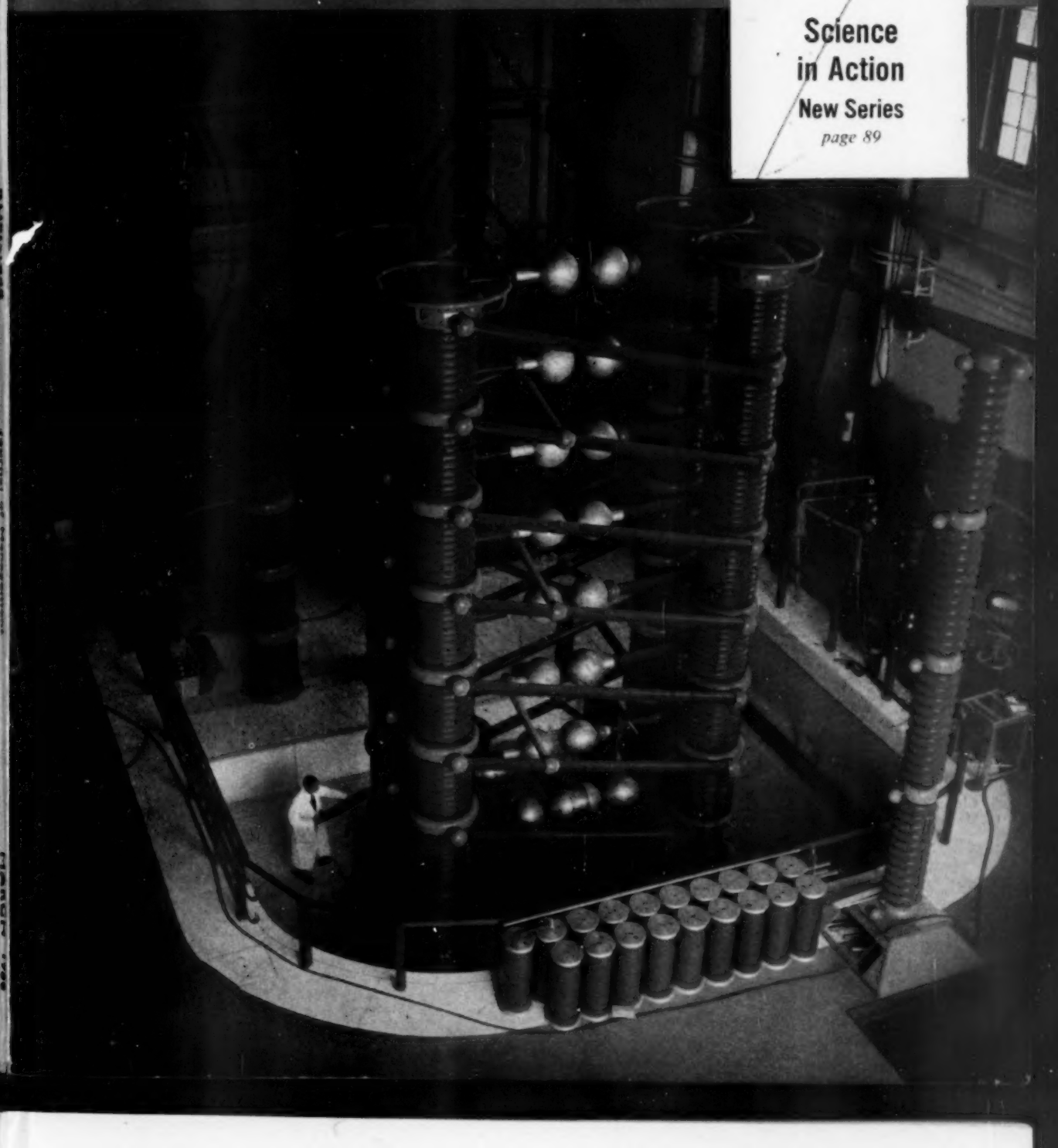

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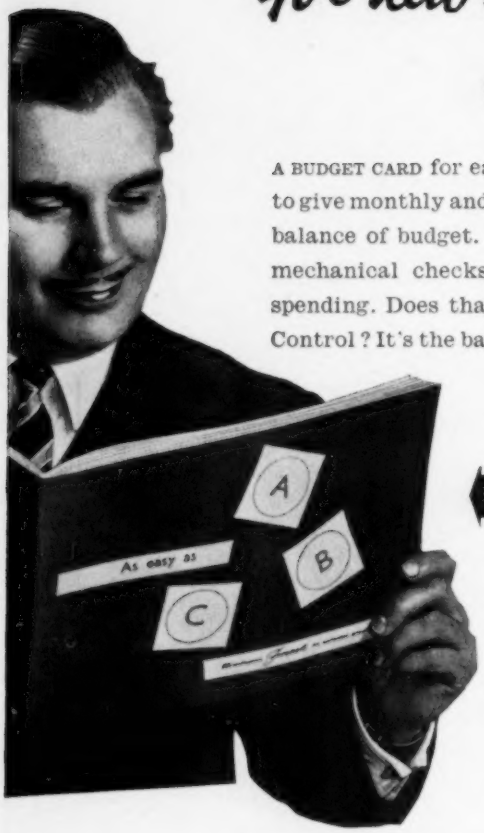

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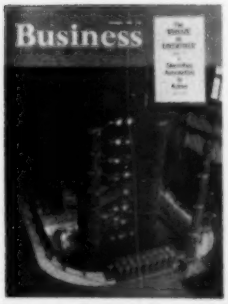

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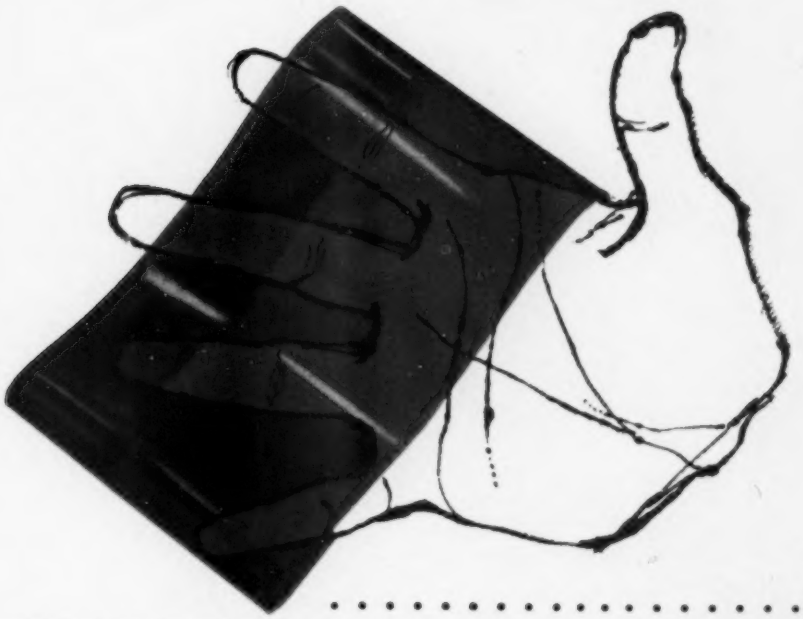

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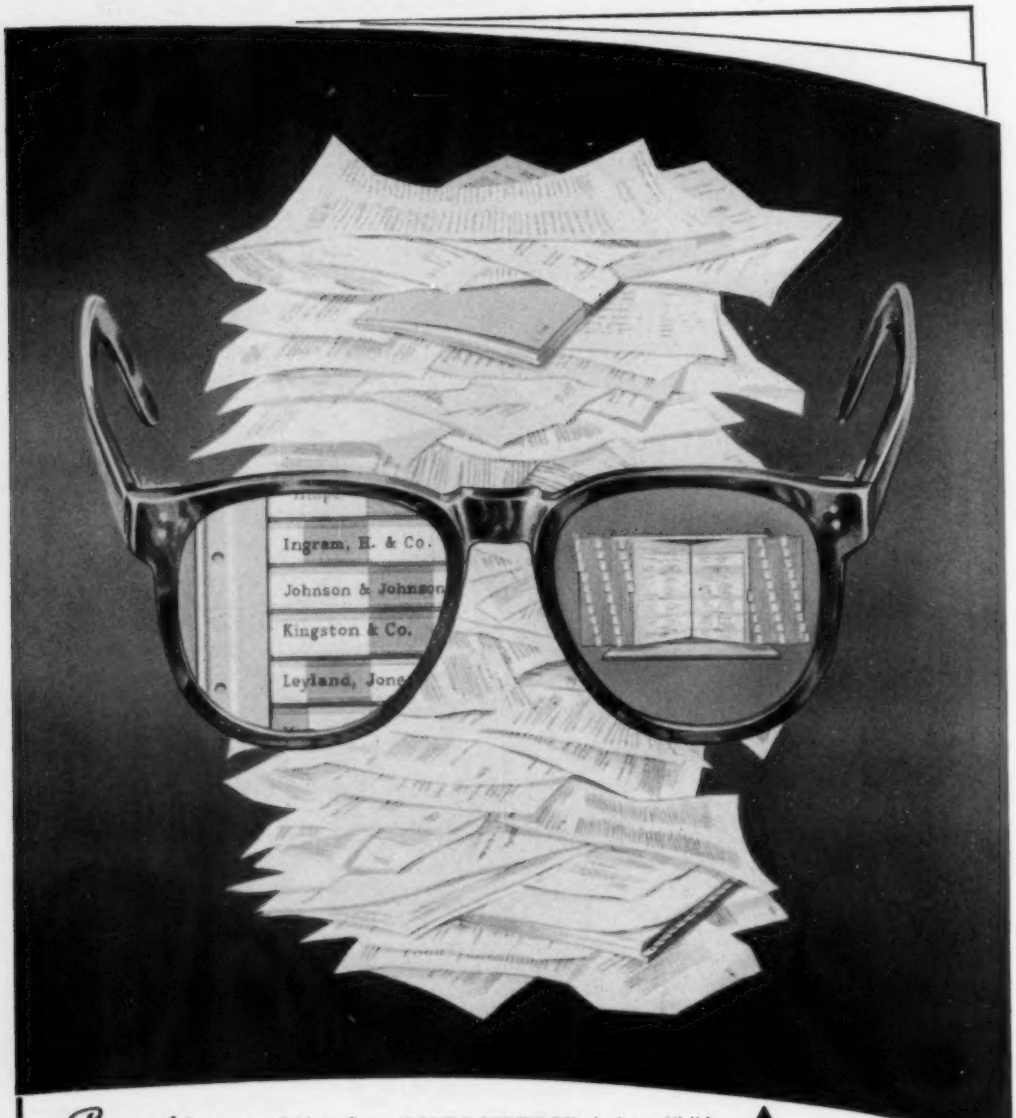

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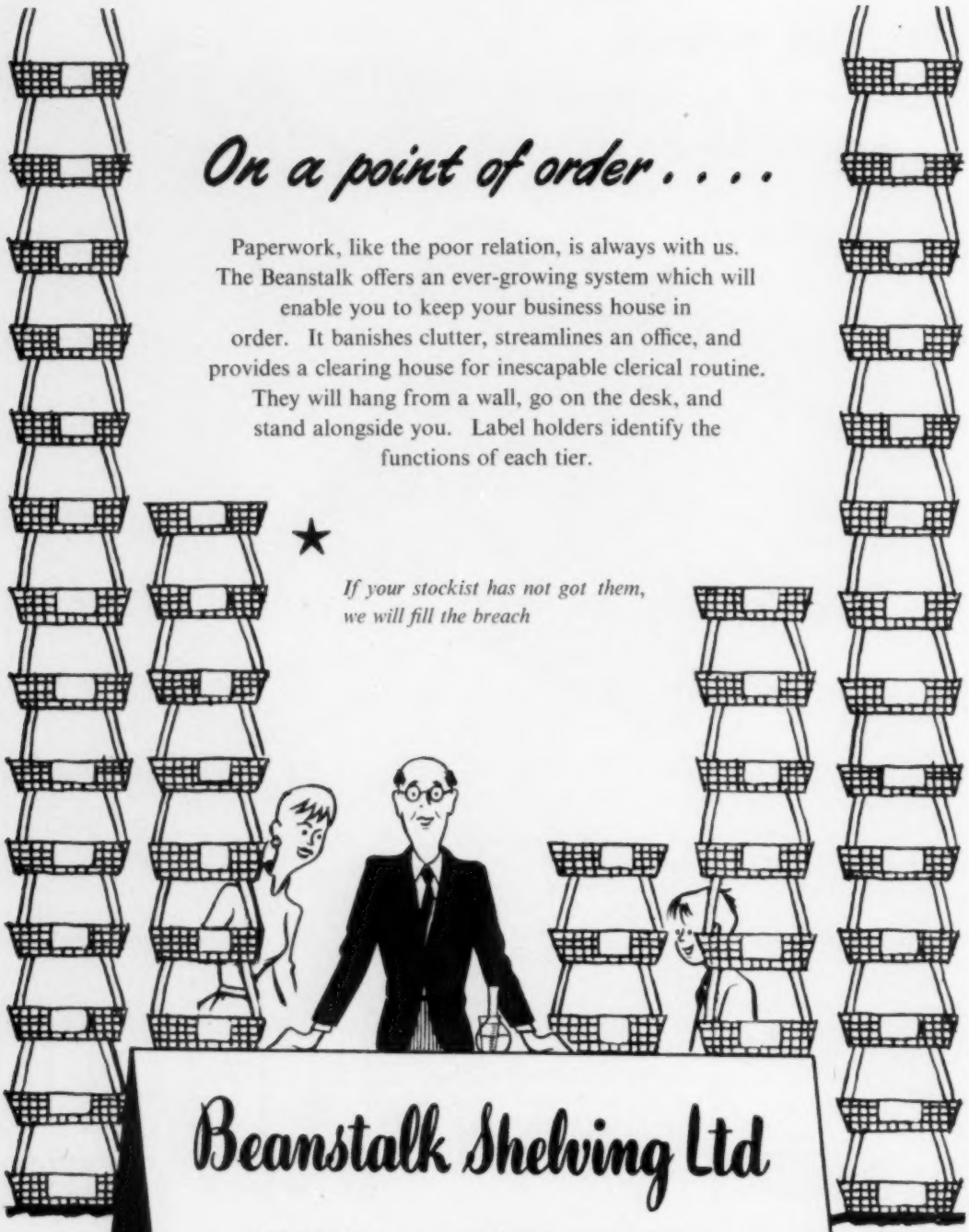

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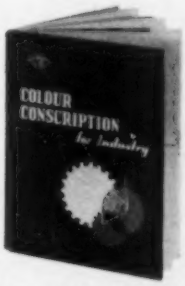

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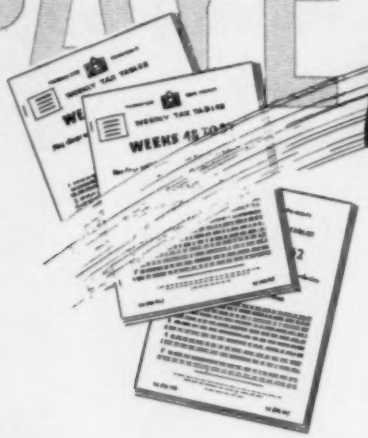

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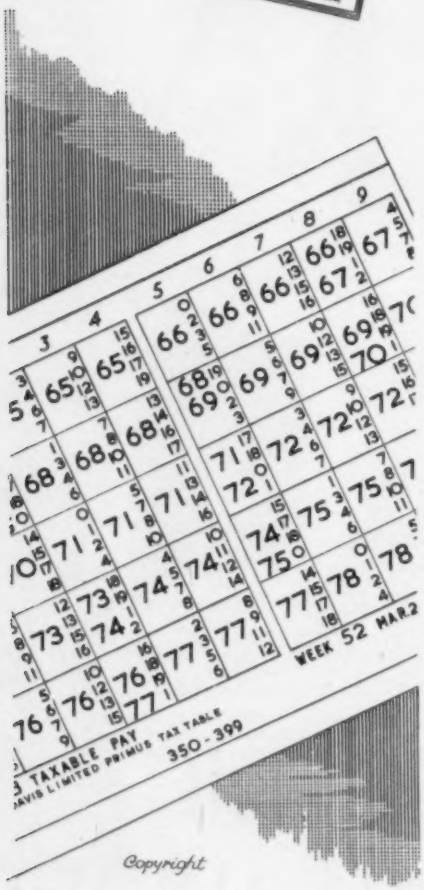

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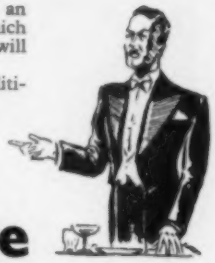

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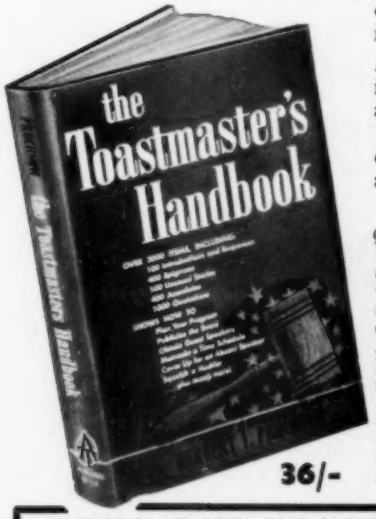

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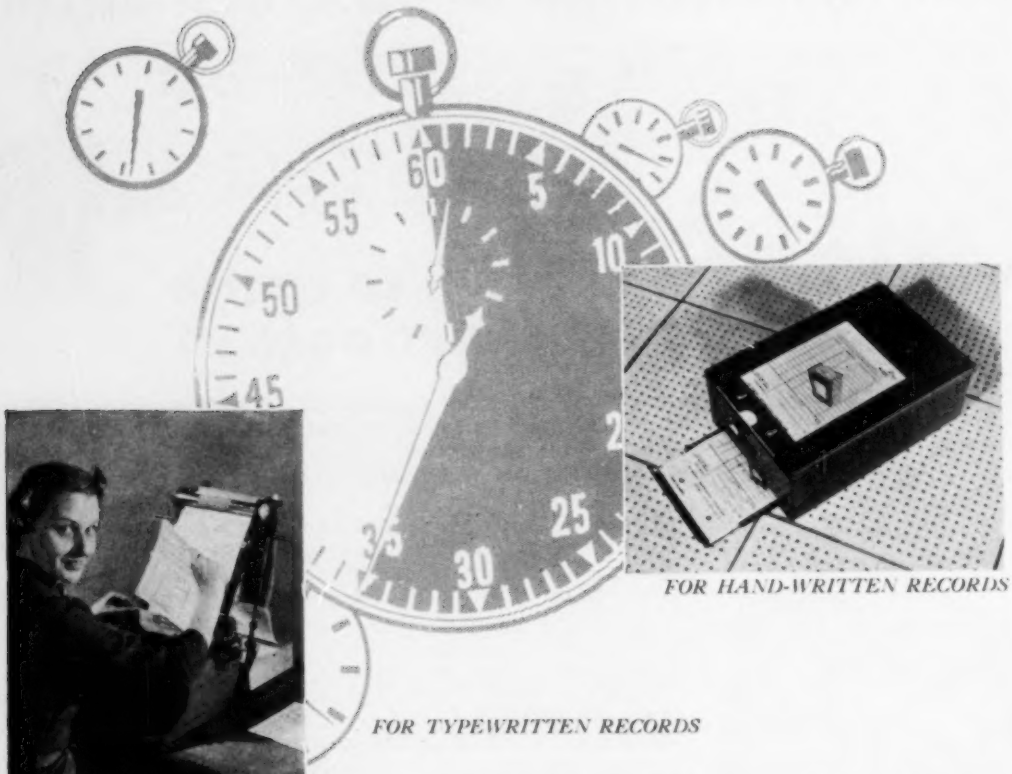

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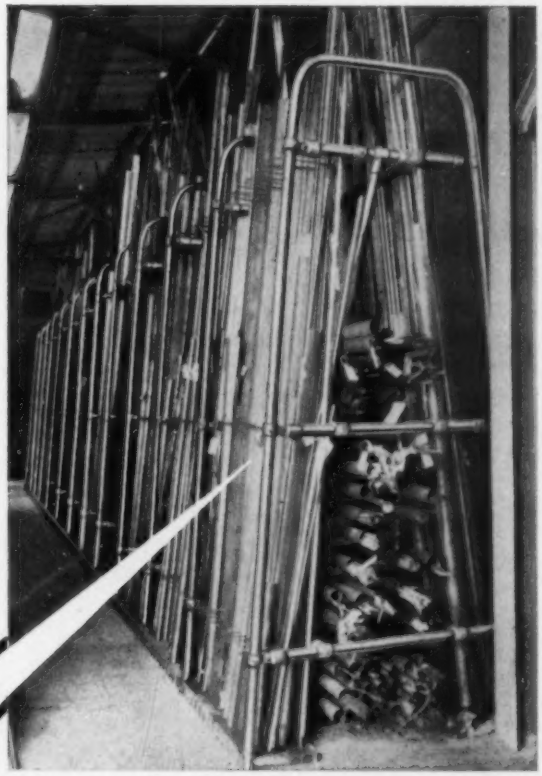

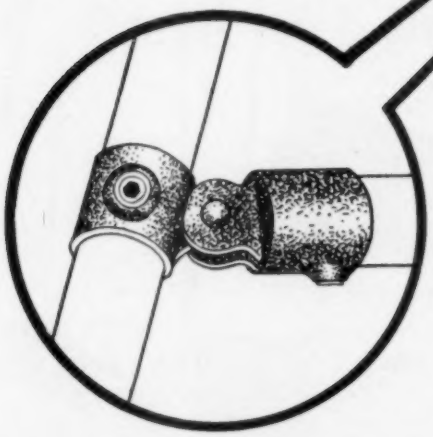

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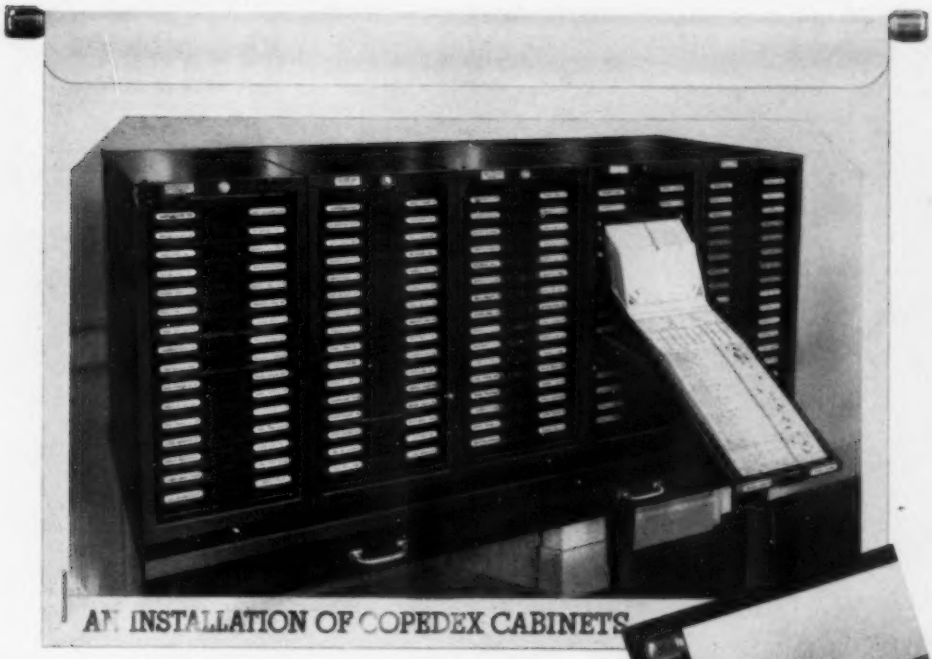

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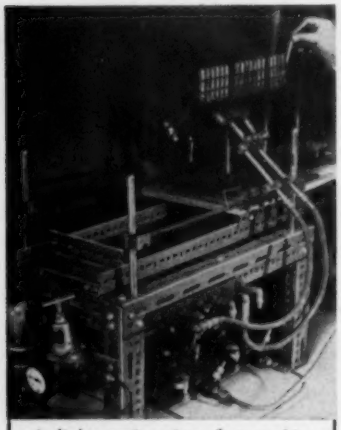

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This is just one example. Dexion is constantly proving that it is the quickest, cheapest, sturdiest material for all kinds of factory and warehouse structures — for storage racks, machine-stands, benches, platforms, trolleys and a hundred-and-one other jobs. With Dexion you make your own equipment *exactly as you want it*.

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Thus Dexion is far easier and quicker to work with than wood or angle iron. Remember, Dexion structures can always be swiftly altered or dismantled, and the Dexion used again. No waste, no scrap.

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Dexion is the slotted angle that started an industry. Now, over 100 million feet of Dexion are being used by more than 60,000 firms all over the world. *And 80 per cent of sales are repeat orders.*

GET THE FACTS

Dexion 225 is sold in packets of ten 10-ft. lengths, complete with bolts. Steel Dexion (price from 1/3½ to 1/5 per foot) is rust-protected, stove-enamelled. Where a light but strong, non-magnetic, non-corroding material is required, use Alloy Dexion (full technical details and prices on request). Send today for sample piece of Dexion and illustrated booklet AW.5 showing many uses in industry. Dexion Ltd., 65 Maygrove Rd., London, N.W.6. (Tel: MAIda Vale 6031-9.)

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If you come across an imitation, compare it with Dexion; check these points:

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- Slots and holes are scientifically placed for simplest, safest construction.
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With Dexion, you benefit from years of research and experience, a world-wide organization, free technical service, and fast construction teams for big jobs.

This special rig *enables Enfield Cables Ltd. to transport heavy experimental 132kV cables to the National Physical Laboratories where, without any further assembly work, they are immediately ready for impulse testing. This structure satisfied an urgent need and reduced cost by over 50%. Dexion, supremely adaptable to changing needs is ideal for special structures.*

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DEXION

REGD.

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Here's Hopkins with his *Wednesday—Thursday* load!

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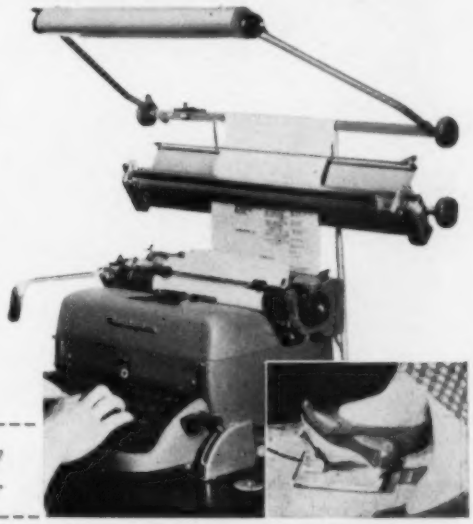

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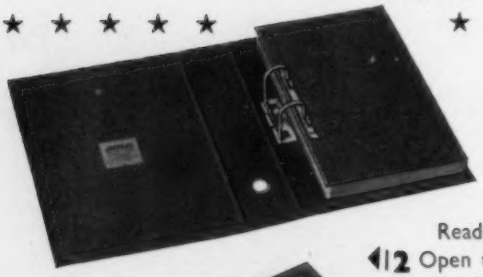
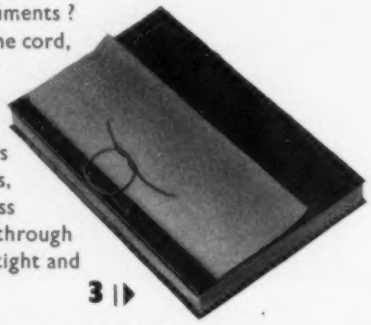


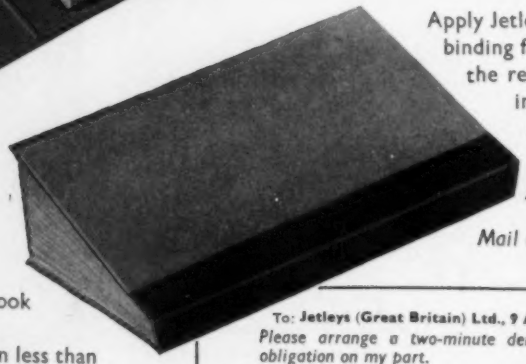
1 This is the inside of your current Jetleys File. Note the easy looseleaf system.

Ready to transfer documents?

2 Open the arch, double the cord, pass the loop through the centre hole, and the ends of the cord through the hollow posts. Lift papers and refills from posts, turn over and pass ends of cords through the loop, pull tight and knot.



3 Apply Jetleys Compound to the binding flap. Bring the flap over the rear of the book (having inserted the spine board) and seal.



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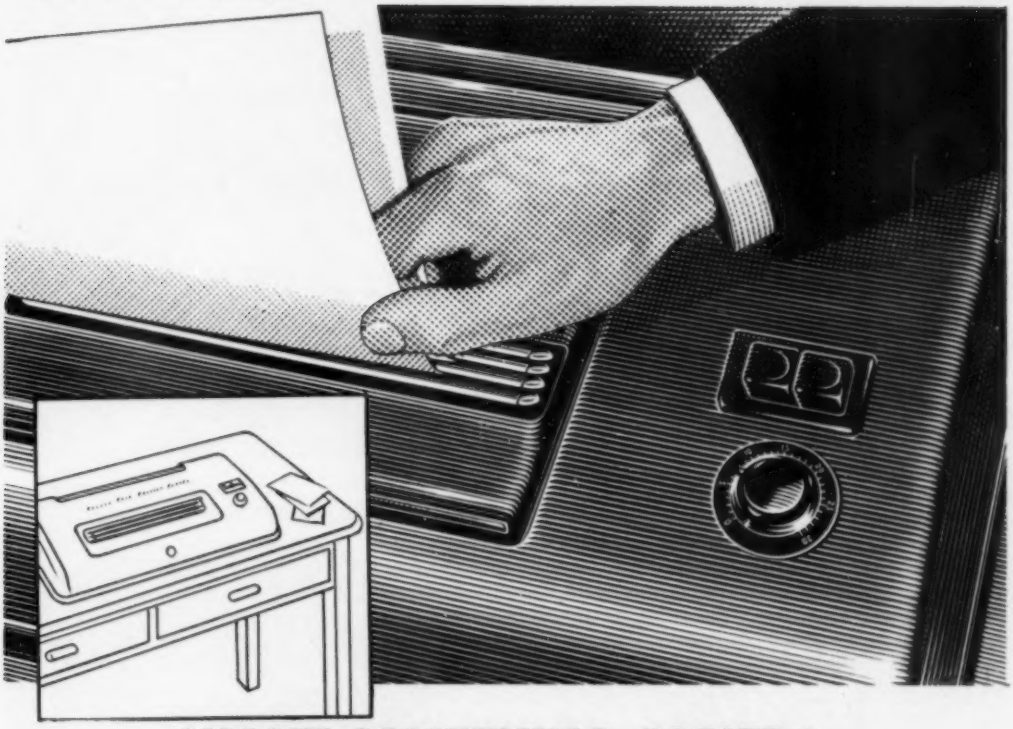

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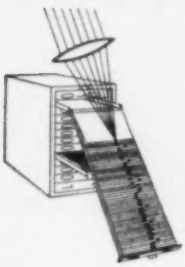

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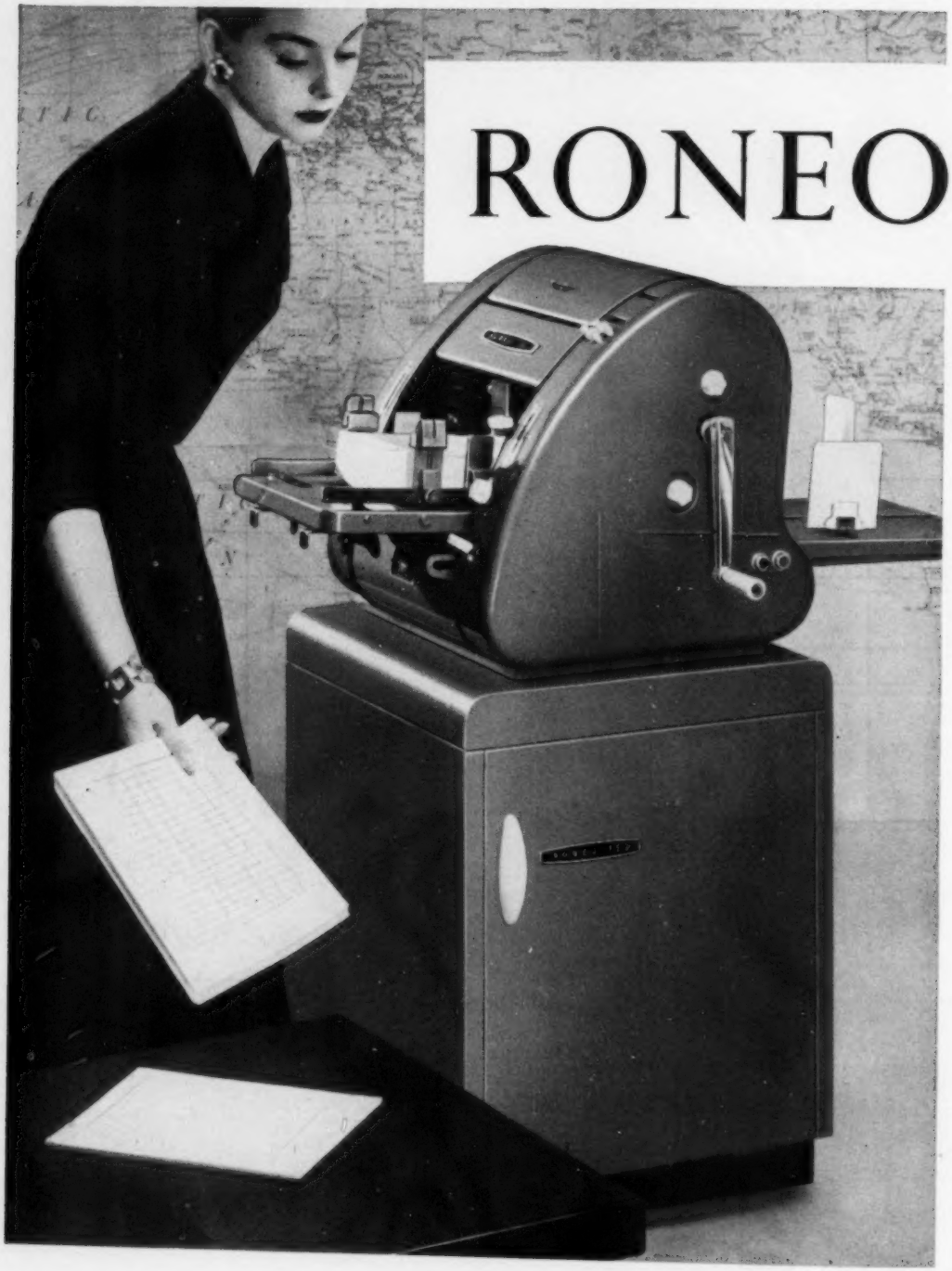
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4 Simple clean colour change	✓	–	–	–
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6 Precision registration	✓	✓	✓	✓
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8 Flexible feeding	✓	–	–	✓
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10 Predetermined quantity printing	✓	✓	✓	✓
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12 Copy angle adjustment	✓	–	✓	–

This table shows how '750' measures up to the essential requirements of modern duplicating in comparison with the foremost duplicators in the world.

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3 in 1 wage systems

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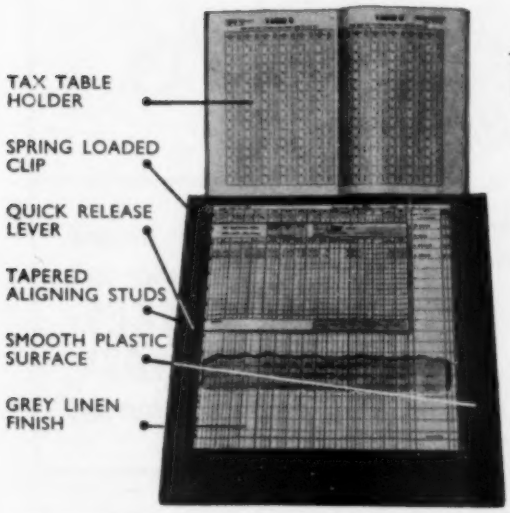

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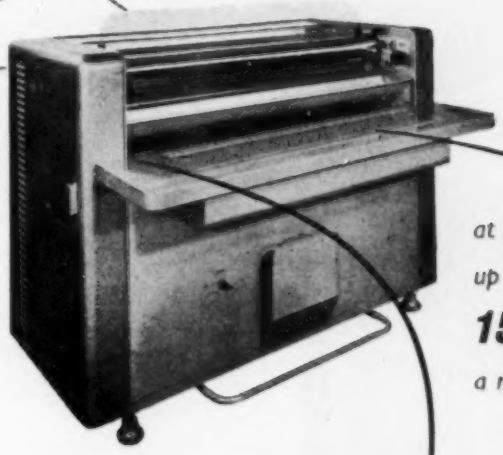

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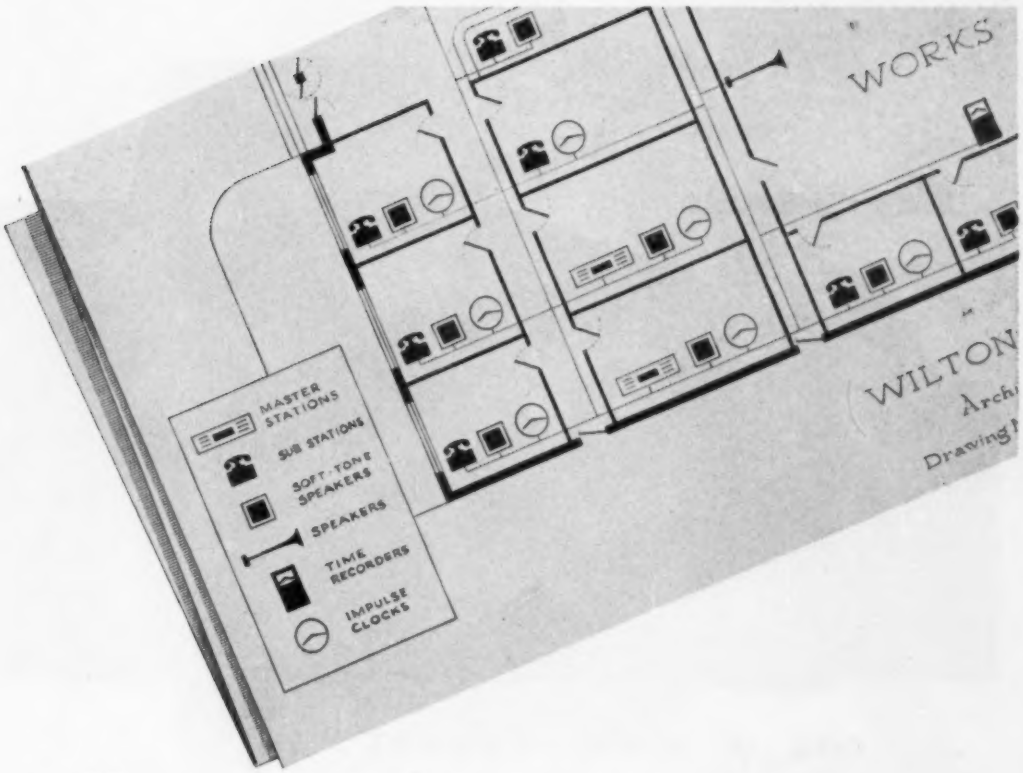

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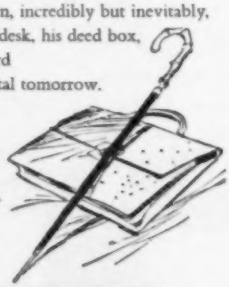

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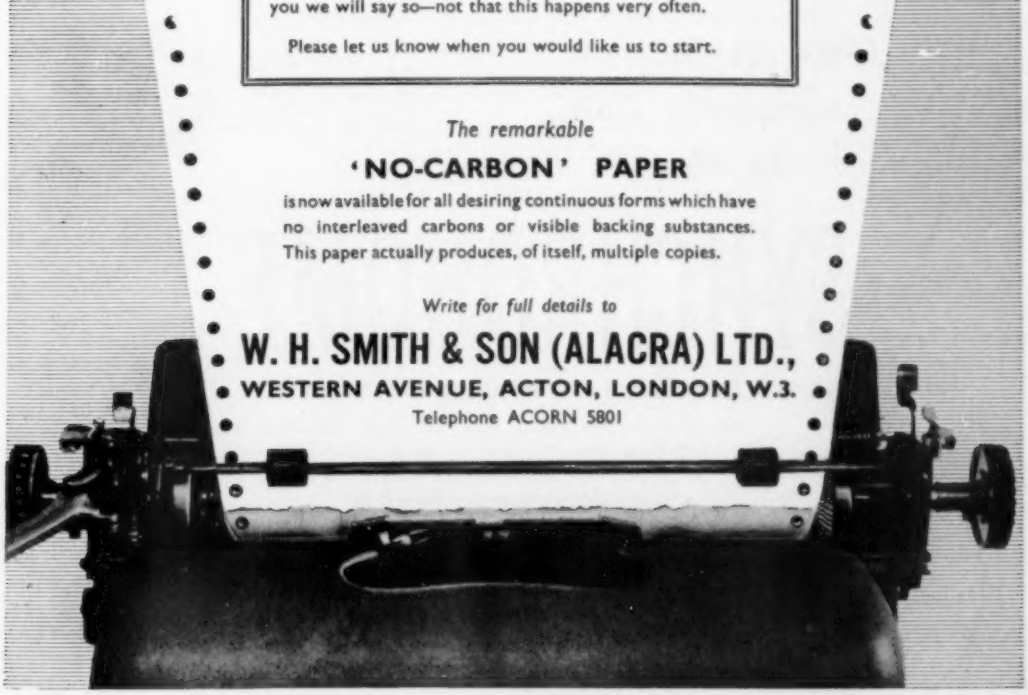

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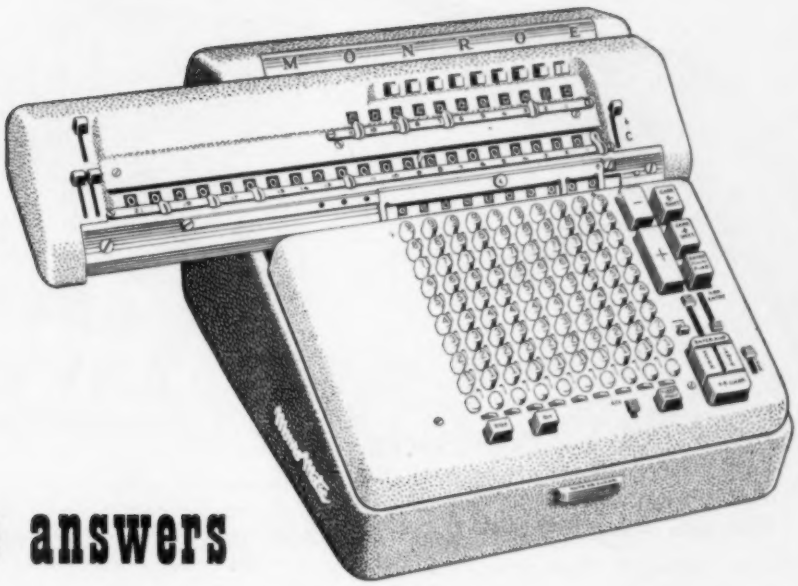

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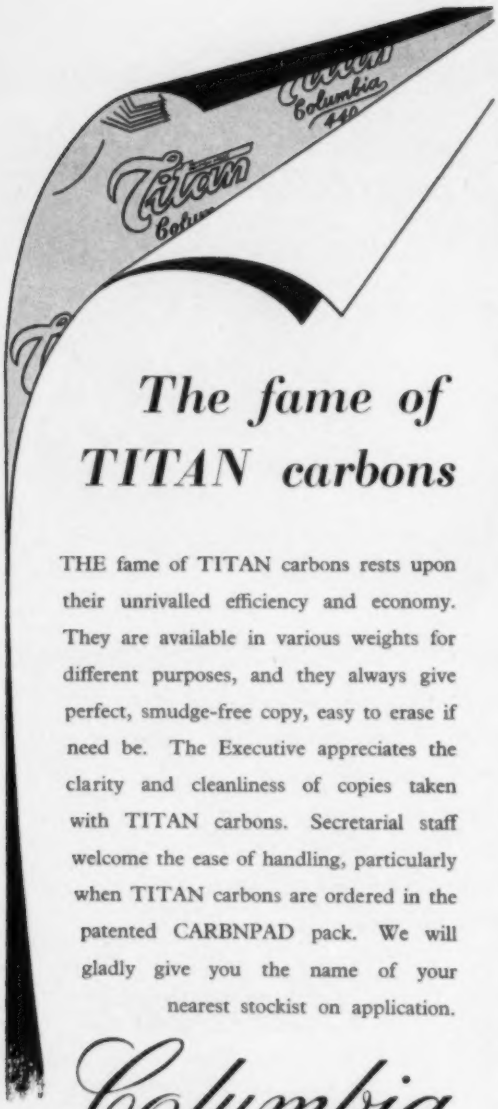
Miss Monroe's so smashing,
So daring and dashing,
You'd never believe she could tackle a sum!
The true explanation's
A simple equation . . .
A Miss plus a Monroe's as cute as they come!



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STA/14

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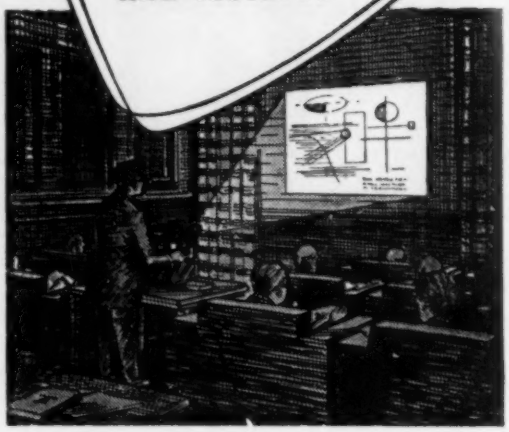

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BLICK MODEL 51

A wood-cased 8 day pendulum, Standard Card-system Recorder suitable where no overlapping problem arises.

BLICK METAL-CASED STANDARD

This smart metal-cased model can be supplied mechanically as well as electrically operated.

BLICK 'CLIP'. The Blick range of Clip-Card Recorders overcome the complication of overlapping shifts and meal-times.

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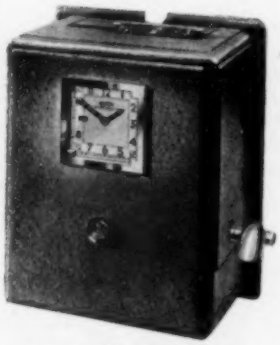
BLICK have the widest and best range of Time Recorders suitable for clocking factory workers. Each Model is designed to meet a particular set of conditions—and the conditions vary a great deal from factory to factory. One of the more complex, expensive Models is essential under some circumstances. In others an inexpensive model will meet all requirements equally well. For example in one factory the complication of overlapping shifts and/or meal-times exists. In another smart modern appearance is considered essential.

If you ring Monarch 6256 and ask for Mr. Maurice High he will give you expert advice as to which of the many different Models is likely to meet your particular conditions most adequately and therefore give you the greatest satisfaction.

Here we illustrate a few of these Models. They can all be supplied Electrically operated and most can also be supplied mechanically operated and they can all be supplied either to print all times in one colour or to print Lateness and Overtimes in a second colour (normally Red). Most models can be supplied in either Wood or Metal Cases.



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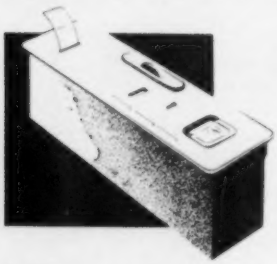

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NOW turn to page 143 for other modern postal aids.

for a comfortable rise in output . . .

When workers (from the chairman downwards) sit comfortably and anatomically correctly, production, paradoxically enough, goes up. You'll find a *comfortable* rise in profits if you make your base of operations an Evertaut chair.

◀ Executive Chair E66

Designed for the senior executive, this chair combines comfort with appearance and is fully sprung and padded. Available in a wide choice of coverings, with principal metal parts chromium plated.

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The 5-in. deep spring-cased seat provides additional comfort and makes this model particularly suitable for the senior typing staff. Seat height adjustable from 19in. to 24in.

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ACME

Why pay postage and purchase tax every year on calendars when an Acme Porcelain Finished Perpetual Calendar is guaranteed to last 10 years and, once in position, will not be taken down? It is a commercial calendar you can see — and not have to peer at. Moreover, the porcelain finish is easily kept dust-free, while the bold date and month cards have a washable finish and are inset in a chromium frame.

Each design is prepared to client's individual requirements, and the above example, made for National Benzole, is printed in three colours and has all the main features embossed. Size approximately 15" high by 12" wide.

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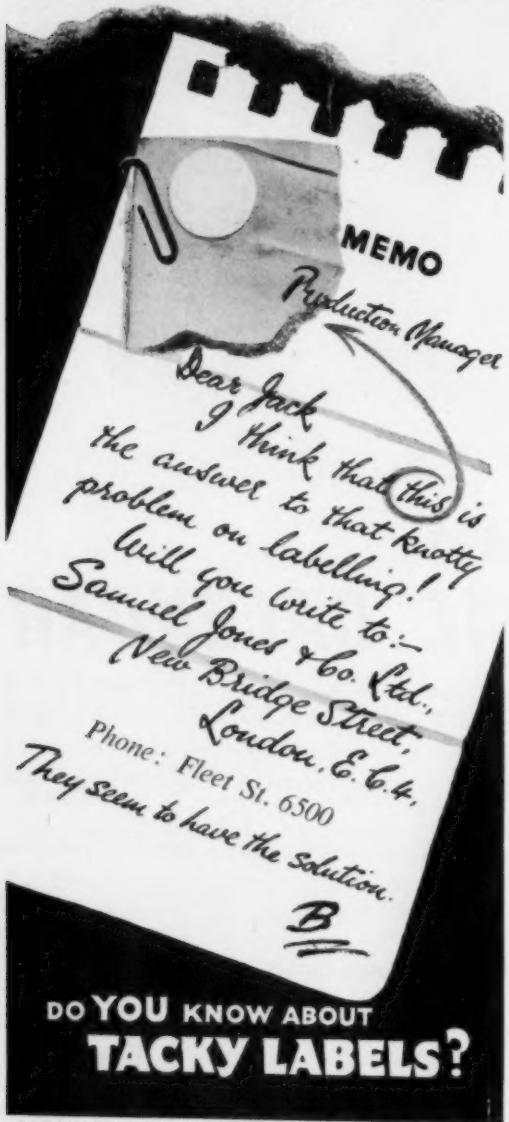
Tacky Labels are particularly suitable for those in Commerce as they adhere to almost any clean, smooth, dry surface. Convenient sheets for overtyping or writing. They keep usable for years, and also strip easily. You just press—they stick and stay stuck. Leather, wood, metal and plastic goods and waxed, varnished or painted surfaces. Send for testing samples.



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"We'll never get them all in!"

How often we've heard that phrase when a canteen is being furnished, but if this problem of limited space faces you, don't despair. We at Shepherd's are experts at this sort of thing. Our free Canteen Planning Advisory Service makes the most use of your available floor space, and provides maximum seating capacity, together with comfort and efficiency. Add to this free service a wide range of durable tubular steel furniture, purpose-built for your canteen, and you'll see that your problems of how to make the best use of limited space are best solved by Shepherd's — experts in the manufacture of tubular steel furniture.

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Your problem will be answered by a visit from our Technical Representative—anywhere in the country.

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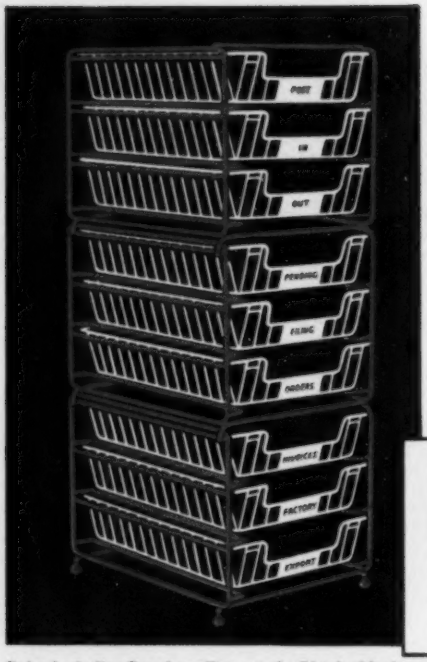

No more untidy desks

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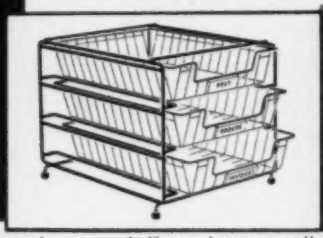
Stabilux is supplied in sets of three trays, complete with frame. These units sit firmly on top of each other and are fitted with removable rubber feet to avoid slipping and scratching. The rubber feet are removed from upper sets before stacking.

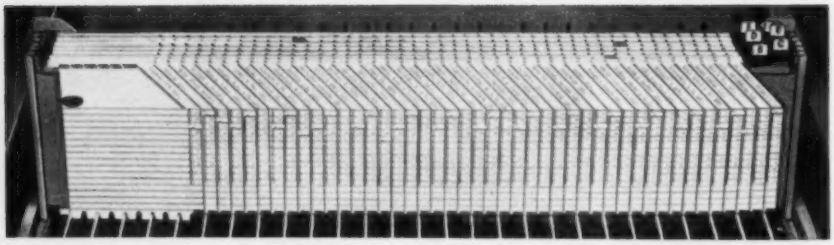
Finished with stove enamelled cream trays. The frames are available in red, blue, eau-de-nil, or dark green.

Build up office efficiency with



Stabilux "BUILD-UP" TRAY SETS

Price including Purchase Tax 43 2d. Obtainable through your usual office equipment supplier or in case of difficulty write direct to:—
HALL & GOULDING (BOGNOR) LTD, SHRIPNEY ROAD, BOGNOR REGIS



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This new economic system from Anson provides *vital facts* for management's particular needs. Stock-Control, Credit-Sanction, Customers' Records, Hire-Purchase, Sales Ledger, Costing. . . . VISIPOST can be applied to any record-keeping problem.

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TGA. FP5/8

ECONOMIC PROSPECT
SURVEY AND FORECAST OF BUSINESS CONDITIONS.

Conflicting Trends

London, February 29, 1956

Although some industries are already having to cut back production, due mainly to hire purchase restrictions, the chance of Mr. Macmillan's recent measures causing a general recession is extremely remote. For the chance of his measures stopping inflation is not so very great. We may face a long period of semi-crisis.

As is suggested on page 71 of this issue, the climate of political opinion in Britain today does not make it very easy for a Chancellor to stop inflation. The great obsession with the idea of equality, and the resulting scramble to get as big a wage increase as the next man, produces an inflationary situation which even the sternest measures will not easily damp down.

Doubtful Tactics

Mr. Macmillan also seems to be using doubtful "propaganda" tactics. His use of a "little Budget" as a means of putting forward anti-inflationary measures is probably outmoded.

The grave disadvantage of the Budget technique at present is that it plays right into the hands of party politics. The Chancellor alone, with his Treasury advisers, is responsible for preparing the Budget measures. The Cabinet—a one-party Cabinet—is responsible for agreeing to them, and they are presented to an expectant House as a party measure, conceived in secrecy.

It is hardly surprising that the Opposition tends to dwell on small and contentious points—like bread and milk—and portray them as part of a wicked and secret scheme to make conditions worse for their supporters. And so powerful is the trade union movement as an instrument of inflation—bidding up its own wage terms—that when it is allied with an active Parliamentary Opposition, use of the Budget weapon for trying to control inflation becomes a very doubtful expedient.

Experts Unused

We live in an age of experts, and any public body or business organization which does not make the best use of expert advice—and the prestige of experts—is missing a trick. The British Government has been repeatedly advised in the Press and elsewhere to set up either a permanent Council of Economic Advisers—like the American Council—or at least a temporary investigating economic committee.

Will the present high Bank Rate seriously interfere with business enterprise? The evidence of Germany's post-war recovery is that a high Bank Rate does not seriously interfere. But will the high rate be effective in helping to control inflation? To answer this, we cannot fall back on German experience, for Germany could use a high Bank Rate much more effectively. They had relatively little national debt and relatively little defence expenditure. Their budget problem was much easier. In the last 4½ years, increases in Bank Rate have raised Government expenditure—on national debt interest—by £250 million a year. In an over-taxed economy, the Bank Rate is not nearly so effective a weapon as in Germany.

Wages Up

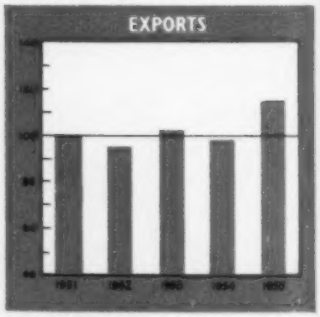
The new hire purchase restrictions may have fairly serious temporary effects on the industries concerned, but less serious long-term effects, because the restrictions are partly countered by increased consumer spending, as wages rise. Claims are still being pressed and granted.

A publication well worth perusing by those looking to the Continent for bigger markets is a 400-page economic survey of the Federal Republic of Western Germany, published by the Stationery Office at 12s. 6d. net or 13s. 7d. post free.

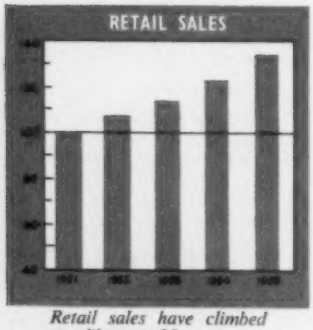
TRADE AND FINANCE

These bar charts depict the state of trade and finance in the October-December quarter of the last five years. The first year is shown as 100.

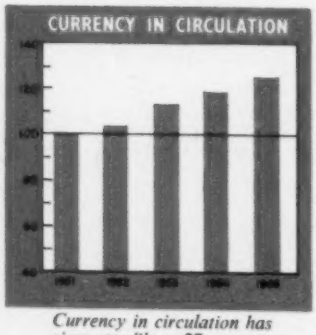
Imports fell by over 20 per cent in 1952, but have since climbed steadily



Exports have had ups and downs, but are now about 15 per cent above 1951



Retail sales have climbed steadily, to 35 per cent above the 1951 level



Currency in circulation has risen steadily to 27 per cent above 1951

Bank deposits rose 8 per cent up to 1954, then fell 4 per cent last year

The nine companies comprising

THE NOBLE LOWNDES PENSION SERVICE

announce record new business results for the year 1955 as under:—

TOTAL NEW ENDOWMENT SUMS ASSURED UNDER PENSION SCHEMES

£49,091,537

UNDERWRITTEN BY 24 OF THE LEADING INSURANCE COMPANIES

In the case of 435 new Schemes included in the above total, corporate trusteeship responsibilities have been assumed by the Group.

To these results must be added:—

ANNUAL PREMIUMS APPLIED TO DEFERRED ANNUITIES £307,724

CONSIDERATION MONIES FOR IMMEDIATE ANNUITIES £772,589

INDIVIDUAL ASSURANCES FOR ESTATE DUTY, HOUSE PURCHASE, ETC. £602,062

*

THE NOBLE LOWNDES PENSION SERVICE are the largest and most experienced pension advisers in the world, employing 5 Actuaries, with Barristers, Accountants, Statisticians, and 102 pension specialists selected from more than 40 different Insurance Companies. The organisation acts as consultants to four Insurance Companies and a number of Insurance Brokers on designing pension provisions of all kinds, and supplementing and modernising existing pension schemes.

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5 EAST CIRCUS STREET, NOTTINGHAM · PHOENIX CHAMBERS, SOUTH PARADE, LEEDS, 1
21 COLLINGWOOD ST., NEWCASTLE-UPON-TYNE, 1 · 58 HOWARD ST., BELFAST · 39 KILDARE ST., DUBLIN
106 FOX STREET, JOHANNESBURG

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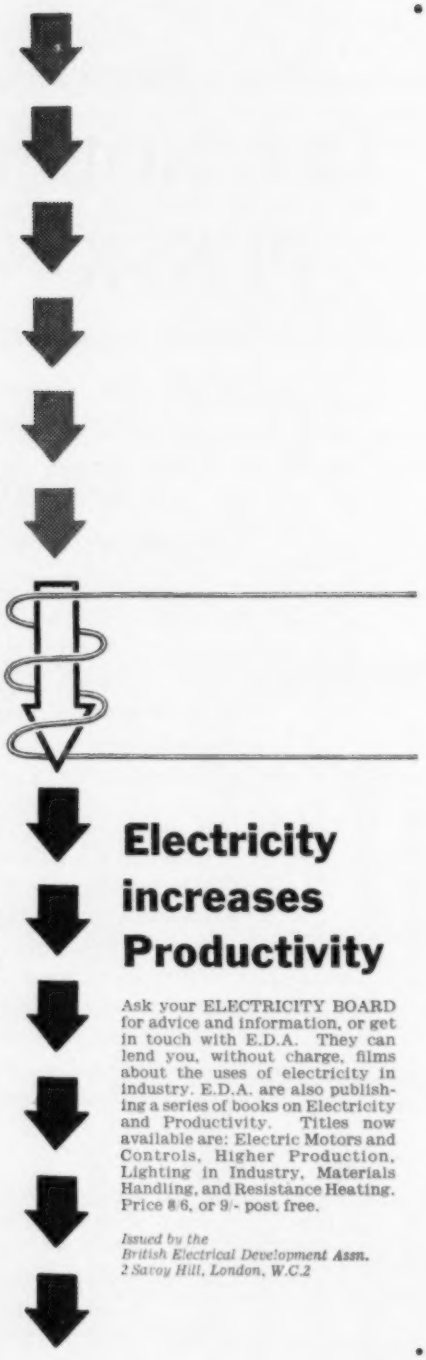
You get much finer control with electricity, too. Temperatures can be controlled automatically—and the constant heat value of electricity means that you know that the treatment is precisely what is required. Not only temperatures but the operation of a complete heating unit can be controlled automatically. Electric heating equipment can be arranged to start, run and shut down to any process requirement or time and temperature cycle.

Heat where you want it, perfect control, cleanliness, lower labour costs and better working conditions are some of the advantages of using electricity for heating. *Heating is just one of the many ways in which electricity plays a vital part in the drive for greater productivity.*



Electricity increases Productivity

Ask your ELECTRICITY BOARD for advice and information, or get in touch with E.D.A. They can lend you, without charge, films about the uses of electricity in industry. E.D.A. are also publishing a series of books on Electricity and Productivity. Titles now available are: Electric Motors and Controls, Higher Production, Lighting in Industry, Materials Handling, and Resistance Heating. Price 8/6, or 9/- post free.

Issued by the
British Electrical Development Assn.
2 Savoy Hill, London, W.C.2

SALIENT FIGURES OF THE MONTH

Production index for December (**8**) was 136, or 10 points below the level in November, and 5 points above the level in December, 1954. The provisional figure for January was 139-40, which compares favourably with 135 for the same month a year earlier. Output of **passenger cars** (**17**) in December was 17,200, a decline of 1,600 on November, but an increase of 2,000 on December, 1954.

Gold and dollar reserves (**30**) at the end of January were £767.5 million, being £9.5 million higher than in December, but £221 million below those in January last year.

Value of exports (**22**) in January was £258 million, an increase of £4.3 million on December, but £1.2 million below the value for a year earlier. **Imports** (**20**) were £346.3 million in January, or £9.8 million higher than in December, and £13.7 million higher than a year ago. **Import price** index (**34**) for January was 105, the same as in December, and 1 point higher than a year earlier. **Export prices** (**35**) were 104, the same as in December and 4 points higher than a year ago.

Registered unemployed (**7**) in January were 264,000, or 48,000 more than in December, but 34,000 lower than for the same month last year. **Total employment in manufacturing industry** (**3**) was 9,337,000 in December, being 47,000 fewer than in November, but 178,000 more than in December, 1954. **Employment in the distributive trades** (**5**) was 2,869,000 in December, or 39,000 fewer than in November, but 58,000 more than in December, 1954.

Retail sales index in December (**25**) was 190, or 35 points higher than November, and 11 points higher than a year earlier.

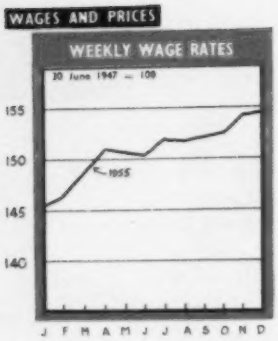
Weekly wage index for January (**31**) was 156, or 2 points above December, and 10 points above the figure for January, 1955. **Retail price** index (**32**) was 153 in January, or 1 point down on the previous month and 7 points higher than a year earlier.

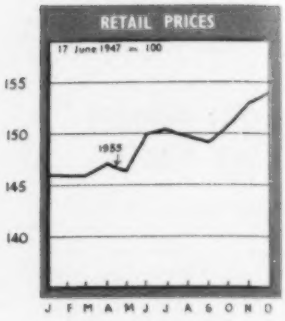
			Latest Month	Increase (+) or Decrease (—) on a Month Ago	Year Ago
'BUSINESS' INDICES					
1. Production	1948=100	*	135·8	+ 1·8	+ 8·7
2. Purchasing Power	(do.)	*	107·7	+ 0·3	— 1·1
MANPOWER					
3. Total manufacturing industries	(thousands)		9,337	— 47	+178
4. Textiles	(do.)		952	— 2	— 39
5. Distributive trades	(do.)		2,869	— 39	+ 58
6. Coal (on colliery books)	(do.)		700	+ 1	— 5
7. Registered unemployed (G.B.)	(do.)	†	264	+ 48	— 34
PRODUCTION					
8. Index of prodn.: total all inds.	1948=100		136	— 10	+ 5
9. Coal (average weekly output)	(thousand tons)		4,286	—387	+154
10. Gas available at gasworks (average weekly output)	(million therms)		62·3	+ 2·3	+ 1·3
11. Electricity generated	(million kWh)		8,098	+509	+744
12. Steel ingots and castings (average weekly output)	(thousand tons)		382	— 17	+ 27
13. Cotton yarn	(million lb.)		13·36	— 1·7	— 2·36
14. Rayon yarn and staple fibre	(do.)		40·4	— 0·5	+ 4·4
15. Worsted yarn	(do.)	*	21·9	+ 1·7	+ 1·4
16. Sulphuric acid	(thousand tons)	*	177·6	— 4·2	+ 14·6
17. Passenger cars (av. weekly output)	(thousands)		17·2	— 1·6	+ 2·0
18. Commercial vehicles (av. weekly output)	(do.)		6·6	— 0·7	+ 1·4
19. Permanent houses completed	(do.)		28·31	— 0·08	— 4·2
TRADE					
20. Value of imports	(£m)	†	346·3	+ 9·8	+ 13·7
21. Value of imports, Dollar Area	(£m)	*	77·4	+ 3·0	+ 12·8
22. Value of exports	(£m)	†	258	+ 4·3	— 1·2
23. Value of exports, Dollar Area	(£m)	†	26·1	— 6·0	— 3·8
24. Freight train traffic	(thousand tons)	‡	5·26	— 0·65	+ 0·03
25. Retail sale index	1950=100		190	+ 35	+ 11
FINANCE					
26. Currency in circulation	(£m)		1,732	+ 50	+113
27. Deposits, London clearing banks	(do.)		6,612	+210	—319
28. Provincial cheque clearings	(£,000)		811	+ 10	— 11
29. National savings, total outstanding	(£m)	*	6,125	+ 2	+ 63
30. Gold and dollar reserves	(do.)	†	767·5	+ 9·5	—221
WAGES AND PRICES					
31. Weekly wage rates	1947=100	†	156	+ 2	+ 10
32. Retail prices	(do.)	†	153	— 1	+ 7
33. Price indices of materials used in:					
Non-food mfg. industry	1949=100	†	154·6	— 0·7	+ 5·5
Mechanical engineering	(do.)	†	175·9	— 0·2	+ 16·9
Electrical machinery	(do.)	†	196·0	+ 0·2	+ 22·6
Building and civil engineering	(do.)	†	140·9	+ 0·4	+ 6·7
34. Import prices	1952=100	†	105	Same	+ 1
35. Export prices	(do.)	†	104	Same	+ 4

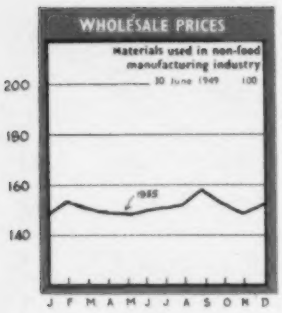
* November † January ‡ Four weeks to January 1st, 1956.
All other figures refer to December

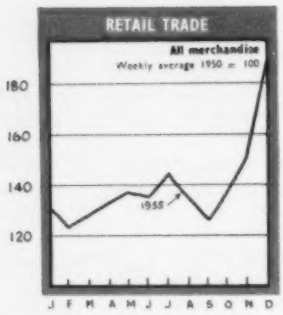
STATE OF THE NATION

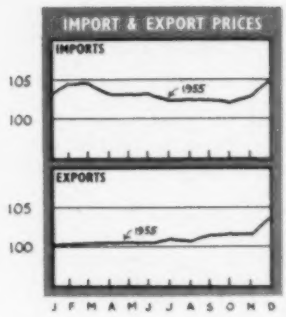
WAGES AND PRICES











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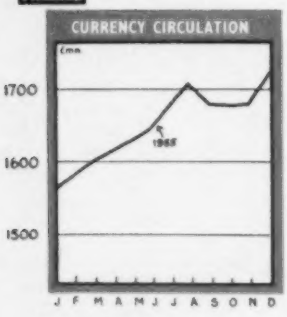

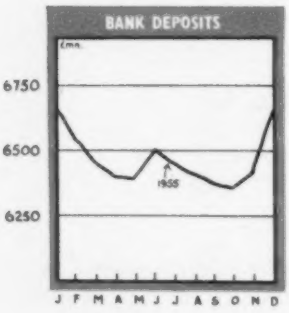

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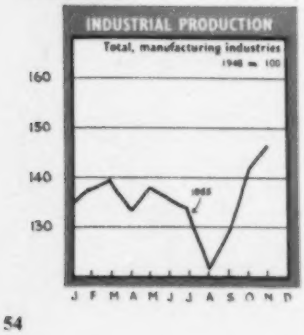
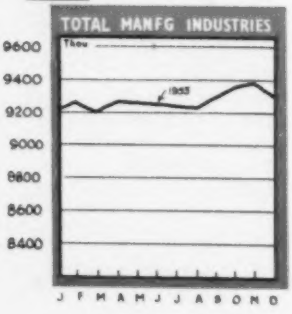


LABOUR



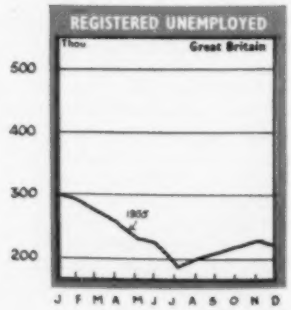


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Photo by courtesy of Elliott Brothers (London) Ltd.

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HOME MARKET SURVEY

A Round Britain Survey: Regional Notes on Markets and Industrial Developments

SCOTLAND

WITH good order books, engineering and shipbuilding firms are looking ahead with some confidence, despite recent labour disputes. Steel deliveries, which have been improving, will be augmented substantially as new plant now under construction comes into operation, and the export market battle is being waged with vigour. Efforts to reduce the emphasis on "heavy" industry continue, however, and there is encouraging news of new industries moving into Scotland. Latest project under consideration is the manufacture of the Harry Ferguson light car, possibly in the Clyde Valley.

Outlook for the textile and jute industries is promising. Research continues, and the new building programme—now nearly completed—of the British Jute Trade Research Association in Dundee will provide around 40 per cent more floor-space, comprising an administration block and new physics laboratories. Prospects are good on the 20 Scottish industrial estates, which now house 360 factories. Many existing companies are expanding production and a number of new tenants are starting to produce. Several U.S. firms will be well in operation by the end of the year.

In spite of increases in capacity, steelmakers are still unable to meet home and overseas demand, which is particularly strong from civil engineers for sections, joists and steel rods. The position will ease when Colvilles' new £20 million integrated plant comes into operation. Progress at Ravenscraig is good, and it is anticipated that the plant will be completed by mid-1957. Pig-iron production of 1 million tons a year and ingot output of 2 million tons will then enable corresponding increases to be effected in the out-turn of plates, sections, bars and other products.

A further new furnace is now in operation at Mossend, and new plant soon to be completed will have a capacity of 60,000 tons of tube a year. By 1958, steel production in Scotland is expected to be running at an annual rate of 2.6 million tons. Work will start in a few months on large-scale alterations and extensions at the Gartsherrie Ironworks, Coatbridge, of Bairds and Scottish Steel Co. The work will cost some £6 million and will enable production of pig-iron to be raised from 150,000 to 350,000 tons a year. Included in the scheme are two new blast furnaces, coke ovens, and ore stocking, screening and sintering plant.

Extensions are being made to the existing capacity of the iron and steel works of Stewarts and Lloyds Ltd., Glasgow, and within three years the company will have doubled their 1946 level of steel ingot production. Coming into operation this year, their second rotary forge tube mill at Clydesdale incorporates many new features designed to give improved economic running and high quality control. It will augment production of casing and line pipe for the oil industry, and will contain heat treatment plant to cope with the highest grades, together with equipment for threading and testing all grades of casing. Capacity of the plant can be expanded to almost twice the present rating, if required.

New Factories. A major feature of Scottish industrial growth since the war has been the establishment of production units by large American companies, currently occupying some 3 million sq. ft. of factory space and employing 13,000 Scottish workers. Their number is to be increased following the decision of the Caterpillar Tractor Co. of Peoria, Illinois, to establish a £5 million plant near Bellshill, Lanarkshire, for the manufacture of tractors and heavy industrial equipment. This is the first time that the company will have produced complete tractors outside the U.S.

Production is scheduled to start in mid-1958 and, in the first phase, about 1,500 employees will turn out 1,500 tractors. The plant is sited only a short distance from Colvilles' new plant which is to roll the highly-specialized steel required for tractor manufacture. Another U.S. company, Ranco, will be employing 1,400 employees when their new £250,000 factory opens up in Scotland this year.

Nearly 3,000 workers will be needed when the £3

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million plant of the Goodyear Tyre and Rubber Co. at Garscadden, Glasgow, comes into full production. Construction work is in progress on the 58-acre site, and it is expected that the plant will start up towards the end of this year. Layout is being planned so that the factory can be expanded four-fold, as necessary.

The new £1 million plant of Grange Chemicals at Grangemouth is now producing high-grade detergent alkylate at the rate of over 10,000 tons annually. The Cleveland Twist Drill Co. are to establish a factory on a six-acre site in Peterhead. Initially, 100 hands will be employed and this number will later rise to 400.

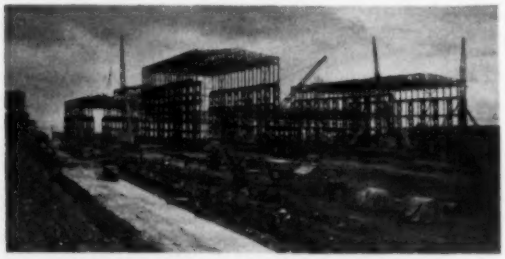
In a factory on Port Glasgow industrial estate another U.S. company, Aircraft Marine Products (G.B.), are planning to build up a large export business in solderless terminals. The present works area is 17,000 sq. ft. At a cost of £15,000 a new factory for the manufacture of knitting machine parts is to be built in Kilmarnock.

Buildings on the new industrial estate at Longman, Inverness, have been taken over by Cable Belt Ltd., a subsidiary of Resistance Welders, to meet demand for their conveyer belting. The Belmos Co. have opened a new research laboratory at their Blantyre Estate factory. Features include short circuit testing facilities and the establishment of test conditions for contactor gear.

NORTHERN IRELAND

AN all-out drive is being conducted to stimulate **industrial production** in Ulster where, since the war 100 new plants have been established and external trade has risen two and a half times. In the period output per man has increased faster than in the U.K. as a whole. Expansion of **technical education** in the colleges and universities will ensure a greater flow of skilled workers, but meanwhile the unemployment total of around 30,000 lends urgency to Government plans to encourage new factories and diversify industrial undertakings.

To date there have been 75 assisted schemes of expansion, and already the majority of these new and expanded plants have reached or exceeded their labour force target figures. Official **inducements**, now being



The £8 million project of British Thomson-Houston at Larne

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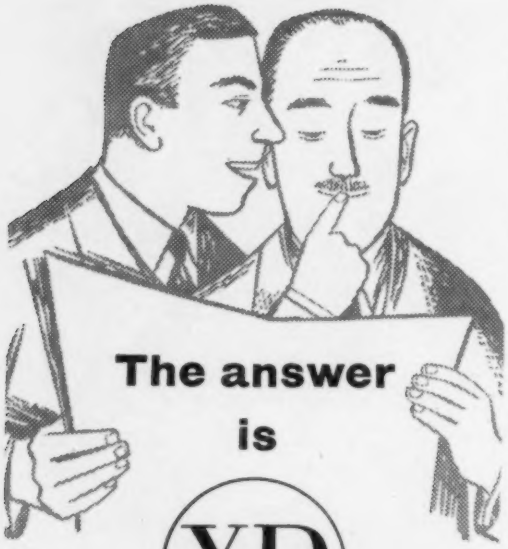

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ECONOMIC PROSPECT

widely publicized by the recently established Development Council under the chairmanship of Lord Chandos, include capital grants and loans, and factory sites and buildings. On hand and planned is works construction that will cost from £7 to £8 million. To meet future demand for such buildings, the Government have increased borrowing powers under the act for the development of new industries from £10 million to £25 million.

New Factories. The British Thomson-Houston Co., who have already embarked on an £8 million project at Larne, are considering the establishment of another new plant that would give employment to 2,500 people. A new factory is being provided on the Castlereagh industrial estate for the British Tabulating Machine Co. who have for some years been the tenants there of two factories, employing more than 1,300 people. The latest extension will give work to a further 700 operatives, and provision has been made in the building plans for a further extension.

Additions now being made to the Larne factory of Corran Works, a Pye subsidiary, will add 500,000 sq. ft. to the production area. Extensions are also currently being completed at the Lurgan plant of the U.K. Optical Co. and the Londonderry works of Birmingham Sound Reproducers.

Lines Bros., who have been manufacturing perambulators at Castlereagh since 1946, are expanding their plant and will in due course provide work for 750 men and women.

U.S. Firms' Progress. Impressive progress is being made by the Hughes Tool Co., the subsidiary of Hughes Tool Co. of Houston, Texas, who began production of mining bits at a modern 80,000 sq. ft. Belfast factory last year. An extension of 16,000 sq. ft. is projected and employment should rise to over 500 people. It was on the recommendation of Hughes Tool Co. that another Houston concern, the Mission Manufacturing Co., first became interested in the establishment of a factory in Ulster. They have now decided to establish an undertaking there and a Government factory is to be erected at Castlereagh.

Pending completion, production of the company's oilfield equipment is being started in a part of the Hughes Tool factory. Plans have been announced for the production of a new lightweight sports car at the Belfast engineering works owned by Mr. Rex McCandless, the racing driver, and his brother. A substantial financial interest in the Doagh Flax Spinning Co. has been acquired by the Linen Thread Co. of Glasgow. As a result of this development the Belfast firm, who have a most modern all-fibre spinning mill at Doagh, will be able to undertake more extensive development of synthetics.

Aircraft and Shipping. Short Bros. and Harland, who are engaged in a sizable new tooling programme, expect to complete their first Belfast-built Britannia—a Mk. 300 for B.O.A.C.—this autumn. The company

Colt planning overcomes heat gains . . . at DRUMMOND BROS.

new Guildford extension

Architects: Brownrigg & Turner, B.A., A/ARIBA
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are now in full production of a new aircraft seat designed for fitting to B.E.A.'s new Viscount fleet.

Over the next two or three years the firm plan to spend well over £1 million on expansion and modernization of plant and equipment. About half this sum will be spent on adding to factory production space.

To diversify their activities, Harland and Wolff are to produce power presses for shaping car bodies, by arrangement with Danly Machine Specialists Inc. of Chicago.

Progress is being made with the expansion of Belfast's dock facilities, and the Belfast Harbour Commissioners are promoting a Parliamentary bill for a £2.5 million programme of development. At Londonderry, work is in hand on the second stage of a £250,000 harbour improvement project which includes the provision of a new dock.

EXPORT MARKET SURVEY

UNITED STATES—1

THERE is something about the $ sign that spells "stupendous." Still basking in the after-glow of its most prosperous trading year and on the threshold of a $400,000 million economy, the United States is today by far the richest market in the world. In 1955, Americans bought more than ever of British fine woollens and shirtings, drank more of our whisky, wore more of our clothing and rode in more of our cars and aircraft: a new record total of £199 million, or 24 per cent more than in 1954, was set up in this country's sales to the U.S. Remembering the pre-war position, it is encouraging to find America now our best overseas buyer of bicycles, woollen piece goods, jewellery and silverware; not so encouraging, however, the drop of 11 per cent in January's export figures.

What does this ebullient market hold in the long term for Britain? Can it maintain its present vigorous growth, and if so, is there a place on the dollar sales train for the small as well as the large U.K. company? Where every statistic is vital and all are astronomical, there is reassurance in the fact that business in the U.S. is by no means all big business. In the main, it is an aggregation of small concerns: 65 per cent of manufacturers have less than 20 workers, 69 per cent of wholesalers operate with five or less employees and 75 per cent of the retailers have a payroll of two or less. In sheer numbers, however, these establishments add up to a formidable total—241,000 manufacturing firms, 34,000 mining enterprises, 240,000 wholesale concerns, 1,770,000 retail outlets and 556,500 service stores.

They are needed to cater for a population that has increased by 27 million in the last 10 years and now stands at 167 million. Total annual personal incomes are topping $300,000 million, and one-third of the wage earners are currently worth $5,000 a year, after taxes. This population is spread out over 3 million square miles, stretching 2,800 miles from east to west

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and 1,600 miles from the Mexican border up to Canada—with temperatures ranging from 118 deg. above to 45 deg. below.

Distribution of goods and services, advertising and transportation are on a correspondingly vast scale and employ 20 million people. The doctrine that the customer is always right is energetically practised as well as preached: last year traders took back from customers merchandise worth $2,000 million.

Population densities vary from states where 50 per cent of the people live on farms to others where 95 per cent of the workers are in factories and mills. Today nearly 100 million people live in towns, and around 85 million of these are in "standard metropolitan areas" of which there are 168. They comprise a county or several counties centred on a city housing 50,000 or more inhabitants, and all these areas vary widely as to climate, custom and occupation.

The sales picture presented by the U.S. is, in fact, not so much that of one single rich territory as of many flourishing markets. In its turn, the sales approach can be just as varied and, to be successful, it needs to be. Some characteristics are common to all areas in America. For example, everywhere there is a restless movement of people: since 1939 about half the total population of the country has moved. This has resulted in a readiness on the part of individual Americans to accept the new, a trend reflected in their predilection for the novel product. But novelty by itself is not enough; it must be made fashionable by advertising and shrewd salesmanship.

Start Small

Such factors must be borne in mind by every U.K. exporter when deciding where to direct his dollar sales effort. It is sound general advice to start small. There is nothing defeatist in concentrating at the beginning of a campaign on one section of the market only. It is common practice for most American firms to try out a new line first in a test area were costs can be kept to a minimum. Once the marketing plan has been streamlined it can be transferred to a wider territory. An alternative is to con-

centrate on selling to a part, or combination of parts of the total market—the photographic market, for instance—or a high income group.

Yet a further method is the "skim the cream approach" in which the effort is restricted to areas where sales can most easily be secured. Of the nation's 3,070 counties, the small number of 282 contain nearly 58 per cent of the population, nearly 70 per cent of the buying power.

Sales Regions

In our second article on the U.S. market next month the division of the country into various sales regions will be considered in detail and an outline given of some of the main economic lines of development, all of which offer potential sales openings for British goods and equipment. Success of a British dollar drive here and now depends very much on the answer given to the question posed at the beginning of this feature: can the U.S. economy maintain its present vigorous growth?

There are some clearly discernable weak elements, high among them the dependence of the economy on a very rapid increase in personal debt. During 1955, home mortgage debt rose by $13,000 million and consumer debt by $5,000 million, an increase of 17 per cent in personal debt compared with a rise in income of only 7 per cent. Consumers, too, are well stocked. Farm income and expenditure continue to decline and there has been a down-turn in housing and in motor car production. Half a million new cars still remain unsold. Chrysler, who were responsible for 18 per cent of the market last year, have laid off one-quarter of their labour force since the middle of December, and Ford dismissed nearly 1,000 workers last month. Mr. Curtice, of General Motors, has prophesied a drop in car sales this year, but, nevertheless, his company are going ahead with a record capital programme of £357 million.

There is probably a levelling-off period ahead, but to date the prospect is being taken calmly. Perhaps the outstanding feature of the U.S. market today is this very calmness, the generally held belief that, while minor ups and downs are unavoidable, they are controllable by Government action, and that, broadly speaking, U.S. prosperity is here to stay.

. . . then the Chairman said, "We've decided to . . .

. . . give a Prestons Chronograph to selected members of the staff for their long and loyal service."

- Present them with a Prestons Swiss Chronograph—the watch with a 101 uses. 17-jewel lever, water-protected, shock-protected, anti-magnetic, fully guaranteed, precision watch with stop-watch action. Available with a variety of movements and dials, ideally suited to those in industry—both at work and leisure. Suitably engraved, it is a very acceptable tax-free bonus—a worthy expression of a Board's good will. Let the thought be father to the deed.
- **Prestons, leading suppliers of precision watches to British Industry, will send chronographs on approval. Write, phone or call. We can also carry out any engraving necessary.**

. . . give a *SWISS CHRONOGRAPH*

from the firm who supplies YOUR Stop-Watches

PRESTONS LTD. Precision-Watch Specialists
DEANSGATE, BOLTON, LANCS.

Established 1869 Tel. 876-7

How one man solved a double problem for a famous department store

Mr. H. T. Tipping, the Burroughs man (on the left), discusses with Mr. Ambler, Director and Secretary of Schofields, the new system, based on Burroughs equipment, that they worked on together for speeding the preparation of customers' monthly statements.

TO Schofields of Leeds, mailing monthly statements promptly to customers became a pressing problem in their constantly expanding business—moreover, filing space for sales dockets took up large areas of valuable shelving.

They called in Mr. Tipping, of Burroughs, who, together with Mr. Ambler, Director and Secretary of Schofields, worked out a comprehensive plan based on Burroughs equipment, including Microfilm.

Now Schofields' statements go out proven, accurate and complete on exactly the right day throughout the month in a regular cycle.

The new statement is as modern as the equipment—instead of an abbreviated extract of debits and credits, the customer now gets the full story of each transaction, together with a summary giving all charges and credits, whilst Schofields have more accurate information on their accounting position, a considerable saving in staff and space and the great benefit of having satisfied customers paying their accounts regularly and early with the minimum of queries.

Whatever your business, if you have an accounting problem, the Burroughs man can help you. Backed by Burroughs' world-wide experience, he will make a full analysis and suggest the most economical, *workable* solution. If he thinks no change advisable, he will say so; if he does recommend a change, he will make a detailed plan and help you get it working smoothly. Call in the Burroughs man—you're committed to nothing. His advice is free.

Burroughs make the world's widest range of business machines. You'll find your local Burroughs office in the telephone book.

Burroughs Adding Machine Ltd., Avon House, 356-366 Oxford Street, London, W.1.

FOR SPECIALIST ADVICE ON MODERN ACCOUNTING METHODS

CALL IN THE **Burroughs** ***MAN***

MARCH OF BUSINESS

IDEAS AND ACTIONS OF FORWARD-LOOKING EXECUTIVES

Grim Outlook for Executives

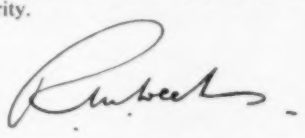
The figures contained in a special feature on page 77 show that unless inflation is halted and tax rates lowered, business executives must look forward to declining standards of living, in spite of salary increases. This situation is so serious that we have asked two outstanding leaders of industry and commerce, Sir Ronald Weeks and Sir Miles Thomas, to comment.

A Leader of PRIVATE ENTERPRISE SPEAKS

Today there are so many people demanding a larger share of the national cake and it is natural that any important minority who do not represent their case tend to get left behind. One might think that business executives would be capable of looking after themselves in this undesirable scramble, but they have Government policy and the taxman to reckon with. As their salaries go up, taxation takes a bigger and bigger slice. Consequently, as the figures published in BUSINESS show, executives face declining standards of living.

No man can be expected to give of his best when, no matter how hard he works, and however much promotion he receives, his standard of living goes down. It is a matter of grave importance to every man, woman and child in Britain that the country's future prosperity should be protected by ensuring that those who accept the responsibilities of industrial leadership are adequately rewarded.

In this there is no room for envy or argument about equality. The essential fact is that unless business executives are offered the prospect of rising standards of living, when they receive promotion to positions of greater responsibility, the nation must say goodbye to all dreams of prosperity.



A Leader of PUBLIC ENTERPRISE SPEAKS

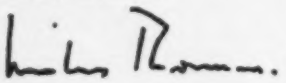
The public has been led to believe that they are standing on an escalator leading up to greater prosperity. If they work reasonably hard, they are told, they may double their standard of living in the next 25 years. But from the figures published by BUSINESS it seems clear that executives are standing on an escalator that is moving down. Due to inflation and high tax rates, they have to run very hard indeed up the escalator to try and stay in the same place, and many of them are in fact steadily having their living standards reduced, in spite of promotion to higher salaries. This seems

SIR RONALD WEEKS, D.S.O., M.C.
Chairman of Vickers Ltd.

SIR MILES THOMAS, D.F.C.
Chairman of B.O.A.C.

to me an extraordinary way to reward those who are leading the drive for higher productivity.

Nor must be forgotten those present executives in public or semi-government services whose salaries are pegged, possibly for political reasons. When the salaries of heads of nationalized industries or State boards remain static, as they have done for seven years or more, their standard of living, in the face of the depreciated £, has inevitably gone down.



That One in a Thousand

SIR Walter Puckey has not been slow to appreciate that much can be done to relieve the shortage of scientists, technologists and other rare birds if the methods of selecting them for the right jobs are improved. He has set up a company, Management Selection Ltd., to specialize in filling managerial and senior technical posts. Its long suite is a new card trick.

E. G. Brisch, the specialist in classifying industrial stores, has turned his mind to the problem of classifying executive talent and recording the details on cards. Jobs are not described according to well-known but misleading labels, such as "chief engineer," but rather according to the qualifications required, the work performed and the types of materials and processes dealt with.

One "secret" of the simple recording system devised by Mr. Brisch is that instead of the 10 to 15 "points of interest" in a man's career being merely recorded on his personal card in the files, *his* code number is punched on each of the cards relating to particular points of interest. That is, if a man is a physicist, instead of merely recording this on his card, *he* is recorded on the card for physicists.

The system is so simple that it can deal with thousands of reference points for a matter of shillings spent on equipment, and firms seeking to fill a vacant position can have immediate reference to a wide range of possible candidates with the right qualifications. Needless to say, it is the *firms* which pay for this privilege, not the applicants. Managing director of this new organization is H. E. Roff, former director of the Institute of Personnel Management. Address is 18 Berkeley Street, London, W.1.

Letters

The Editor, BUSINESS
Sir,

I was most interested to read on page 71 of the January issue of BUSINESS that it is your experience that the G.P.O. are reluctant to conceal wiring in new buildings.

My company has been building office blocks and depots on a very large scale during the post-war years and we have had no difficulty of the kind you mention. On the contrary, we have found the G.P.O. very co-operative indeed and the finished results in all of the buildings bear witness to the success of our united efforts to keep wiring unobtrusive. Naturally, as with any efficient contractor, the G.P.O. insist that cables are reasonably accessible for any maintenance repairs or extensions that may be required. This, with a little forward planning presents no difficulty.

Our normal procedure is to send plans of the buildings to the telephone manager of the area concerned, showing all proposed positions for apparatus, with the request that he informs us what sizes of conduits, etc. will be necessary for his cables. This information is invariably given promptly and completely. We then draw up electrical layouts, including the ducts and conduits required by the G.P.O. and send one of these plans to the telephone manager. It will therefore be seen that success depends upon forward planning. Obviously, the G.P.O. cannot conceal wiring if no conduits, ducts or false skirtings are available to them; nor could anyone else.

Yours faithfully,
K. W. FIDLER
(Communications Manager)
Shell-Mex and B.P. Ltd.
London, W.C.2

(We have also received from the Post Office Engineering Department, Leith House, Gresham St., London, E.C.2, a copy of their booklet "Facilities for Telephones in New Buildings." It contains a foreword by the president of the Royal Institute of British Architects pointing out that "Post Office engineers have always been axious to collaborate and advise architects and builders." Although this has not been our particular experience, it is news which deserves spreading.—*Ed.*)

HIGHLIGHTS OF THIS ISSUE

page

Executives feel the Pinch 77

Will tomorrow's executives be better off? The answer is No. A BUSINESS survey shows that salary increases are being more than offset by inflation and taxes.

Science Prospect-No. 1 89

Plain language guide to "programmed" machine tools—which bring the benefits of automation to one-off and short-run production.

Cutting Office Costs 109

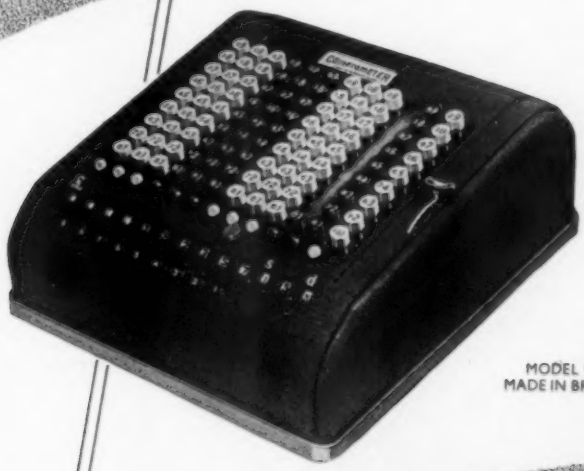
How a new "punched tape" cash register brings "office automation" within the reach of the smaller firm, abolishing clerical work in sales analysis, job costing and stores control.

Staff Training 102

How 12 engineering firms formed a group apprenticeship scheme which is now being adopted on a national basis.

If it's not made by Felt & Tarrant it's not a Comptometer

HIGH · SPEED · ELECTRIC · ADDING · & · CALCULATING · MACHINES



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Employment Depts. & Training Schools in every big town

THE COMPTOMETER
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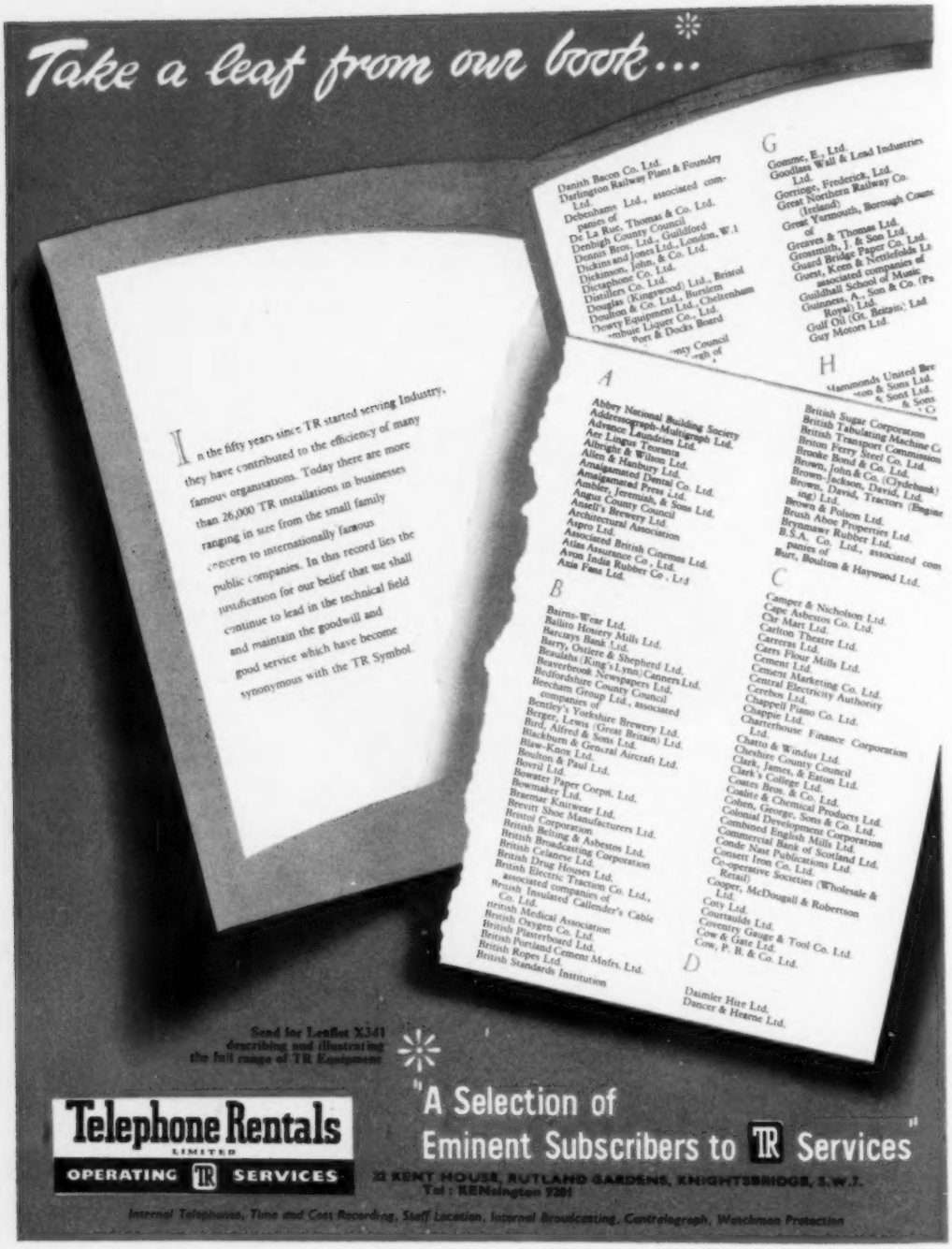
Take a leaf from our book...
In the fifty years since TR started serving Industry, they have contributed to the efficiency of many famous organisations. Today there are more than 26,000 TR installations in businesses ranging in size from the small family concern to internationally famous public companies. In this record lies the justification for our belief that we shall continue to lead in the technical field and maintain the goodwill and good service which have become synonymous with the TR Symbol.
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Dowty Equipment Ltd., Cheltenham
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Grosmith, J. & Son Ltd.
Guard Bridge Paper Co. Ltd.
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Beaverbrook Newspapers Ltd.
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Bovril Ltd.
Bowater Paper Corpn. Ltd.
Bowmaker Ltd.
Braemar Knitwear Ltd.
Brevitt Shoe Manufacturers Ltd.
Bristol Corporation
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British Broadcasting Corporation
British Celanese Ltd.
British Drug Houses Ltd.
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British Medical Association
British Oxygen Co. Ltd.
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British Ropes Ltd.
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British Sugar Corporation
British Tabulating Machine Co.
British Transport Commission
Briton Ferry Steel Co. Ltd.
Brooke Bond & Co. Ltd.
Brown, John & Co. (Clydebank)
Brown-Jackson, David, Ltd.
Brown, David, Tractors (Engineering) Ltd.
Brown & Polson Ltd.
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TALKING POINTS

EQUALITY
Is it Our National Bugbear?

IN all the talk of inflation and how to stop it, one important factor is generally overlooked. There has been a tremendous change in the climate of thinking since pre-war days, and it is now generally accepted—perhaps too readily accepted—that an important goal in British economic life is a higher degree of equality. One of the major political parties actively claims this as its objective, and the other major political party does not openly challenge their claim. But can we ever stop inflation while this pursuit of greater equality goes on?

Here are some posers. There is a continual outcry that the country needs more scientists, technicians and men of good managerial calibre. But the margins of income paid to men of skill, of professional knowledge and organizing ability are getting narrower and narrower. Is not the pursuit of equality one of the causes of the shortage of suitable leaders for industry? In spite of the educational opportunities available today, can sufficient young boys be encouraged to spend many of the best years of their lives studying for qualifications, if at the end the extra pay they receive will be minute — and growing smaller?

Again, one cause of inflation is said to be a shortage of capital. There is too much consumption, and not enough saving. But is not the trend toward greater equality reducing the incomes of the very people in the investing, business, executive and professional classes, who traditionally have done nearly all the saving? How can we have more saving if we reduce the margins of income paid to those who usually do the saving? It is worth noting that neither in Russia, the outright communist country, nor in the United States, the outright capitalist country, is the degree of equality as great as in Britain. And neither of these countries has anything like such a shortage of skilled men or of savings. Also, neither is troubled with inflation to the extent to which it is known in Britain.

During and immediately after the war it was official policy to allow some upgrading of the rates of pay of the very lowest paid in industry, even when widespread wage claims were discouraged. Later, when wage claims for all became more general, these claims were generally based on the view that everybody should get the same rise—the man on £5 a week and the man on £10 or £15. These two policies in succession have narrowed margins for skill, and consequently many of today's disputes are arguments about margins.

An equalitarian movement which no doubt started out sincerely with the desire of narrowing the "margin" between capital and labour, has become very much a struggle between different types of labour as to exactly what share of the cake each should have. And there is no possible final answer to this sort of question. It involves value - judgments. The T.U.C. General Council will never be able to answer this problem satisfactorily for all its members, short of taking dictatorial powers and telling each union exactly what they should have.

The fault surely lies in putting so much emphasis upon the importance of equality. Does it really matter so much that one person should get less and another more? Is not the desire for equality mere pandering to envy?

★

PACKAGING
Does It Get Enough Attention?

"PACKAGING absorbs at least 50 per cent of the labour force in the consumer goods industries, and not less than that amount of factory space. It absorbs no less than 25 per cent of the total cost of production. But does it get that degree of attention from top management?" This point was raised recently by John E. Evan Cook, J.P., president of the Institute of Packaging, when he announced the first national conference on packaging to be held at the Grand Hotel, Brighton, from April 12-14.

Mr. Cook added: "In America, it is known that four out of five people employed in most consumer goods factories are concerned with packaging, and only one on production. The same figures will not hold good in Britain. . . . Usually, packaging is left to be worked out as best they can, individually, by works managers, production managers, sales managers, chief chemists, transport managers and purchasing officers. One seldom hears of a packaging co-ordinator or a top-flight packaging manager. . . . This is the outlook the conference will be concerned with, and which it wants industry itself to recognize, and to change."

The conference will not be confined to Institute of Packaging members, but is open to all industry.

★

REDUNDANCY
Do We Worry About It Too Much?

IN Russia's recently-published Five Year Plan one word recurs that should sound a serious warning to the West—'Automation.' It is quite clear from the Plan that if Western countries have shown wariness in applying such methods to increase productivity, partly because of doubts about the effect that such developments might have on labour, the same scruples have not been shown by the government of the country that has always since the Revolution boasted that it stood more than any other for the cause of the "workers." There is no suggestion, either, in the Plan that employers will be required to keep the same number of men on the job as there were before the introduction of automatic control.

The Plan contains long explanations of the role that automation will be expected to play in every sphere of industry from the manufacture of radio components to steel works and oil refineries.

WHY has the **EMIDICTA** DICTATION SYSTEM *become pre-eminent in only six years?*

FACT 1 The Emidicta dictation system is specifically designed to speed the work by speeding the letter.

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FACT 3 The Emidicta dictation system has been consistently proved *a prudent investment*, not an expensive luxury.

FACT 4 The Emidicta among all other dictation machines is notably uncomplicated.

FACT 5 The Emidicta Dictation System is that most often selected by business organisations after careful comparisons.

BACKGROUND TO EMIDICTA

The Emidicta has the finest possible 'sound' pedigree—it is made by E.M.I. ("His Master's Voice", Marconiphone, Columbia, etc.) And is the outcome of half a century's experience in sound recording and reproduction.

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Also Sales Offices: Birmingham (Midland 5821), Glasgow (Douglas 6061). E.M.134

PEOPLE

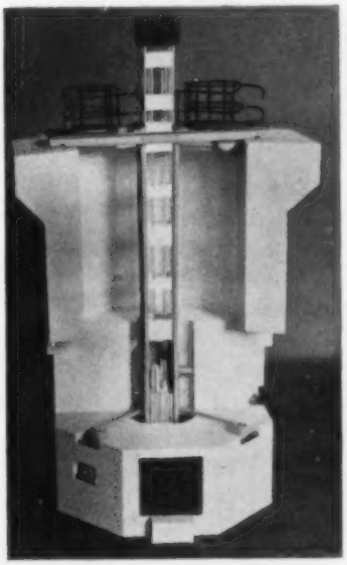
PRODUCTS

PLACES !

DOLLAR MAGNET—Designed to attract dollar customers, the new London showrooms of Austin Healey Cars are located in North Audley Street—close to the American Embassy. Smart, but not over pretentious, the showrooms are decorated in quiet colours which tend to emphasize the brilliant finish of the cars. The tile floors are impervious to grease.

GLOBE TROTTER—James Steel, director of Steel and Co., the Sunderland heavy engineering group, firmly believes that wives can be a great help in business. Mrs. Steel accompanied him on part of his recently-completed tour of world markets. Her assistance, he said, was invaluable in establishing social contacts during the evenings. His trip took him to the Middle East, Japan, Australia, New Zealand, and the United States.

ATOMIC TRAINER—Britain's first privately-owned research reactor, to be built at the A.E.I. research establishment at Aldermaston Court, Berks., will make an important contribution to training young engineers in nuclear physics. Besides being used by the A.E.I. group, the reactor will be made available to universities, technical colleges, and institutions for undergraduate and postgraduate education. The picture shows a scale model of the reactor now being built.



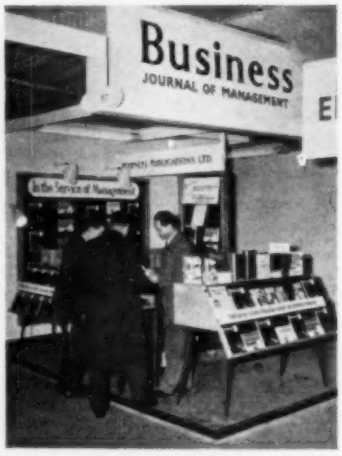
OFFICE DANGERS—Safety is a subject which tends to get overlooked in a busy office, but plenty of hazards exist in most. This picture shows a few potential accident causes—can you spot them? The Royal Society for the Prevention of Accidents has produced a booklet, "Danger! Office Staff at Work," which spotlights practices which are dangerous but not obvious.

PEOPLE
PRODUCTS
PLACES 2

PLASTIC HOME—A new technique was developed in the construction of this all-plastic caravan. It has an outer shell moulded in five sections from glass reinforced resin, and an inner shell moulded in similar material. Between them there is an insulating layer of aluminium foil. Even the sink, water tank, and roof lockers are made of a special plastic material.

SCIENTIST - DIRECTOR — The appointment of Brian Goodlet as chief engineer and director of Brush Electrical Engineering Co. is further evidence of a modern trend to recruit scientists as top executives. As the deputy chief engineer at Harwell Atomic Energy Research Establishment, Mr. Goodlet, was in charge of the design study of the Calder Hall nuclear power plant. He starts his new job on April 1.

"BUSINESS" ON SHOW — Brilliant red covers of the 240-page February issue of BUSINESS, mounted on a black background, made the BUSINESS stand at the B.E.E. one of the most striking of the exhibition and attracted many visitors. Also shown on the stand were the other journals and reference books published by Business Publications Ltd. and its associated companies.



BIGGEST PROVINCIAL B.E.E.—The Lord Mayor of Birmingham, Ald. A. L. Gibson, in opening this year's Business Efficiency Exhibition, congratulated the organizers on the biggest show outside London that had ever been held. He paid particular tribute to the way in which Bingley Hall had been colourfully decorated.

THROUGHOUT THE WORLD . . . *as in BRITAIN*

in **HONG KONG,** *Colony of Contrasts—where a rickshaw and a luxury limousine park side by side—teeming tenements and modern 'sky-scrapers' cast their shadows over picturesque streets. A century ago this crowded cosmopolitan scene was a barren rock. Principal Exports: Cotton Yarn and Singlets, Enamel-ware, Electric Torches.*

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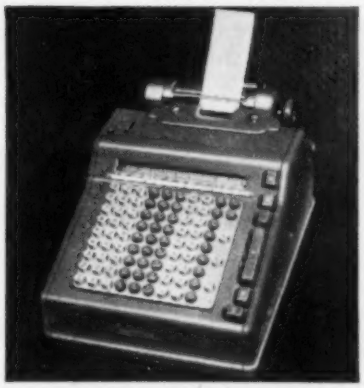

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Figures in this article show that if inflation continues and the present high tax rates are not reduced, the executives who lead the nation's drive for higher productivity will be "rewarded" with declining standards of living, even though they may be given rapid increases in salary. By contrast the average wage-earner has been led to expect that he may double his standard of living during the next 25 years. The article also presents 10 personal case histories of executives' living standards, and compares British tax rates with the more generous rates in other countries

The 'Squeeze' on Executive Living Standards

By **GEORGE COPEMAN, Ph.D.,** *Editor, 'Business'*

MOST readers will be aware that, due to inflation and high tax rates, business executives have suffered a big decline in standards of living since pre-war days. Last April we quoted in BUSINESS figures to show that a junior executive who then had a salary of £1,000, had a standard of living equivalent to that of a pre-war executive with a salary of £360; an executive with a salary of £3,000 had a standard of living equivalent to a pre-war £909. In the last Budget 6d. was knocked off the standard rate of income tax, but since then the price level has risen by over six per cent. So the difficulties continue.

Although the past trend of executive standards of living has been rather grim, what is even more important to the young and ambitious executive today is the future trend. And I am sorry to say that the outlook for the future is even grimmer than a glance at the past figures would suggest.

In the past the combined effects of inflation and high tax rates have been somewhat masked by the fact that most lower and middle executive salaries were in the £1,000 to £3,000 class, and therefore were paying no surtax or only the lower rates of surtax. But the bottom limit of the surtax scale, namely £2,000 income, has been unchanged since 1919. If it remains unchanged in the future, while inflation goes on, then executive salaries will move further into the higher part of the tax scale. The increase in gross income necessary to gain a certain increase in net income, and keep up with the cost of living, will become greater and greater.

Whenever there is discussion on executive salaries and tax rates, it is generally agreed that there should be some tax relief at the lower levels of the surtax scale, for those on incomes of £2,000 up to say £5,000. And this view enjoys a certain amount of "popularity," because so many executives have their salaries within this range.

Very little thought is given to the men whose salaries are beyond £5,000. But it is important to the lower executives that the men at the top should also get tax relief. For high tax rates reduce the value to the top man of an increase in salary. They make him think in terms of other forms of reward—expense allowances, business trips abroad, titles and other honours — rather than think of a straight salary increase. But any damping down of top salaries depresses the whole salary scale. For the executive who is half-way up the ladder, there can be few things more important than that "the boss" should get himself a good rise in salary, and enjoy something worthwhile from it. That creates the right atmosphere for other rises lower down, though unfortunately taxation

makes it very hard to create such an atmosphere in Britain.

In the United States top executive salaries run up beyond the £100,000 mark, but salaries of such dimension would be quite meaningless in Britain, because from £15,000 onwards the tax rate is 18s. 6d. in the pound. As will be shown later, these rates of tax on executive salaries are much higher than those pertaining in the lands of our leading industrial competitors, the United States and Germany, or in the leading Dominions to which the ambitious young Briton can emigrate.

We now propose to examine, therefore, the particular significance of inflation and of high tax rates for the future of young British executives. Assuming that tax rates remain the same in the future, we propose to look at the prospects of three typical executives. First there is the junior executive earning say £1,000 a year —let us hope fairly early in his career. Then there is the quite successful executive earning say £2,000 a year before reaching the age of 40, and lastly the executive who has done particularly well and is earning say £3,000 in his early forties.

For the executive who is half-way up the ladder, there can be few things more important than that "the boss" should get himself a good rise in salary and enjoy something worthwhile from it

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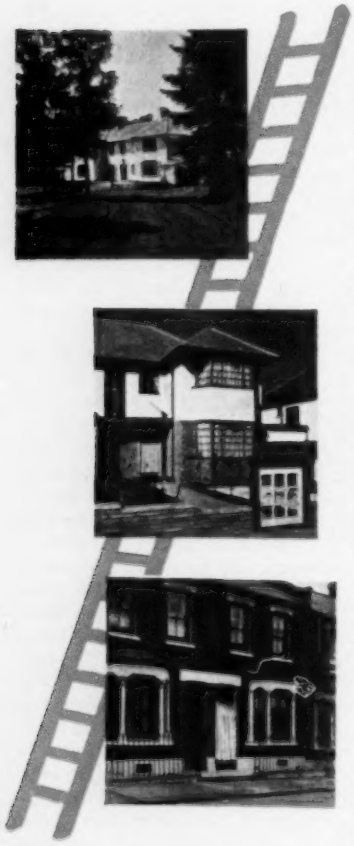

In October, 1953, the then Chancellor of Exchequer, Mr. R. A. Butler, made an important speech in which he held out the prospects to the British nation that if they "invested in success" and worked hard, there was no reason why they should not double their standard of living in the next 25 years. This prospect was held out to everyone—even the least capable and the least ambitious.

Presumably Mr. Butler meant to include business executives amongst those who would benefit from a rise in the general standard of living. At any rate he did not specifically exclude them. But bearing in mind the possibility that during the next 25 years the average wage-earner who is not over ambitious and who works well but not too well, may see his standard of living doubled, we now propose to look at what will happen to the standard of living of our three chosen typical executives who are earning £1,000, £2,000 and £3,000 per annum at present.

The present executive who is in his forties and earning £3,000 per annum will, in 25 years' time, be right up to retiring age. And having been very successful, he may possibly be chairman or managing director of a big company. The other typical executives, at present on £2,000 and £1,000, may also hope to reach quite senior positions during the next 25 years.

These typical executives will, during the next 25 years, be key men in the drive for greater productivity. On their efforts, perhaps more than on the efforts of anybody else, will depend our prospect of doubling the general standard of living.

One might therefore expect that they should share in this prospect of doubling their standard of living. Some people might even think that they should be allowed to do better than the average, as a reward for the key work they will undoubtedly be doing. But at least they should be allowed to share in the new benefits. Do the figures presented here suggest that they will share? Unfortunately, no.

To simplify our figures, we will assume that each executive has a wife and two dependent children. During the next 25 years the number of his dependents will, of course, vary, and later in life these executives may have no dependent children. But on the other hand, in the later years they may take on other responsibilities, such as supporting or helping to support an elderly or invalid relative. Therefore it is not unreasonable to assume, throughout the period, a standard rate of dependents' allowances equivalent to having a wife and two children.

Inflation Rate

What rate of future inflation should we assume in our calculations? Between 1938 and the end of 1955, the retail price index in Britain went up by over 150 per cent, making an average cumulative rise of 5.3 per cent per annum. Between the middle of 1945 and the latter part of 1951—that is, during the period of Socialist government—prices rose by 43 per cent, or an average cumulative rise of 5.7 per cent per annum. Between November 1951 and November 1955 —four years of Conservative rule—prices rose by 19.5 per cent, or an average cumulative rise of 4.9 per cent per annum. But during the year 1955 alone, prices rose by 6.2 per cent.

From all these figures it seems reasonable to conclude that unless there is a radical change in *effective* government economic policy, prices may rise by no less than an average of 5 per cent per annum in the future.

It is appreciated that these cost of living index figures do not accurately reflect changes *from year to year* in the cost of living for executives. But we are concerned here with a long period of 25 years, and if over such

a long period the cost of living index rose by an average of 5 per cent, it would not be unreasonable to assume that the cost of living for executives had risen by similar magnitude.

Inflation is very deceptive, and the executive who gets an annual rise in salary tends to feel he is better off, even if these increases no more than compensate him for rising prices. An executive who received increases in salary which averaged 5 per cent per annum would probably feel that he was doing fairly well, even in a time of inflation. For example, if he started on £1,000, in 25 years his salary would have risen to £3,388.

29 *Per Cent Down*

But if inflation were also to proceed at 5 per cent per annum, and present tax rates were maintained, in 25 years' time the executive who now has a gross salary of £1,000 (net £914 10s.) would need a net salary of £3,100 to maintain his present standard of living. However, his salary after tax, presuming that he has on the average annual 5 per cent increases in gross salary, would be only £2,206, and so his net standard of living would have declined by 29 per cent. As the following figures show, those on higher incomes would fare even worse.

Change in Standard of Living

£1,000	executive,	down	29%
£2,000	,,	,,	38½%
£3,000	,,	,,	42½%

Perhaps, however, we should assume that executives will receive increases in salary averaging more than 5 per cent per annum if inflation goes on. Let us assume 7½ per cent per annum. This would produce some really big salaries in 25 years' time, as shown below.

Now	*Then*
£1,000	£6,095
£2,000	£12,190
£3,000	£18,285

What about their standards of living? The executive who now earns £1,000 would have barely maintained his standard of living—in fact he would have increased it by 1 per cent, as compared with the expected doubling of standard for the average wage-earner. But higher executives would still see a decline. Here is the comparison.

Change in Standard of Living

£1,000	executive,	up 1%
£2,000	,,	down 20%
£3,000	,,	down 30%

Whether you take the whole period since pre-war, the period of Socialist Government or the period of Conservative Government, the average annual rate of inflation in each case has been around 5 per cent

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If inflation is to go on at the same rate as in the past, and tax rates are to remain unchanged, it is tempting to ask what average annual increase in salary executives will need to double their standard of living during the next 25 years, and so keep pace with the expectations of wage-earners? The annual increase, in the case of an executive now on £1,000 a year, would be around 15½ per cent, and for an executive on £2,000 or £3,000, it would be between 16½ and 17 per cent. This would mean earning fantastic salaries in 25 years' time. Below are the figures.

Now	*Then*
£1,000	£36,300
£2,000	£96,700
£3,000	£139,000

These ridiculous figures are themselves a strong condemnation of both inflation and high tax rates.

Let us now return to the supposition that the executives who are going to lead us in the great productivity drive, which will double the average standard of living, receive an average annual increase in salary of only 7½ per cent. How would they then fare if inflation were to go on, but they were also given a tax concession?

We have already referred to the fact that one of the difficulties about tax rates and inflation is that executive salaries are moving further and further into the high tax brackets, and it is not merely a case of reducing the lower rates, but also the high rates.

One of the simplest ways of doing this would be to remove the present limit on the earned income allowance. At present the earned income allowance is two-ninths of earned income, but there is a limit of £450. This means that the allowance cuts out at a salary level of £2,025—or just inside the surtax scale. If the limit were removed, the executive who at present earns £2,500, and who must pay 11s. in the pound on any increase in salary, would have his marginal rate of tax cut to 8s. 6½d.

The £5,000 man would have his marginal rate cut from 14s. to 10s. 10½d., and the £15,000-and-upwards man would have his rate cut from 18s. 6d. to 14s. 4½d. (Thus he would be allowed to keep a little over one-quarter of every extra pound he earned. This does not seem very unreasonable.)

Now let us look at the effect of this hypothetical tax concession on the future prospects of executives—assuming that they obtain annual salary rises averaging 7½ per cent, and that prices continue to rise by 5 per cent per annum. The junior executive now earning £1,000 could, under these conditions, look forward to a

rise of only 19 per cent in his standard of living during the next 25 years. Higher executives would receive smaller rises. Here is the comparison.

Change in Standard of Living

£1,000 executive, up 19%
£2,000 „ up 12%
£3,000 „ up 5%

These modest increases are, of course, much more appetising than the falls in standards of living which would result if no tax concession were given. But clearly even such a tax concession as suggested here would not provide the necessary incentive to the key men who will lead the productivity drive. Inflation must also be tackled — and tackled seriously.

If wage-earners are to achieve a doubling of their standard of living, then we may surely expect that, if inflation goes on, the various personal tax allowances will be increased so that a large number of wage-earners will continue to escape paying income tax, and many others will continue to pay only at the lower rates. Such increases in the allowances will, of course, also benefit to some extent executives higher up the tax scale. But their position will not be greatly improved. Increasing the allowances at the bottom end of the scale would not, for example, alter the fact that surtax starts at £2,000.

Tax concessions at the bottom of the scale, such as increases in personal and dependants' allowances to keep pace with the cost of living, are insufficient to prevent declining standards of living for "star" executives

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If inflation is to continue, executives can only expect real relief if the tax scale is spread out over a wider range of salaries, as well as being pushed up at the bottom end. To illustrate this, we will suppose that in the next 25 years the tax scale is *not* extended outwards over a wider range, but is only pushed up at the bottom, the personal and dependants' allowances rising with the cost of living. If this were to happen, the present allowances of £440 for a married man with two children would have to rise to £1,490 during the next 25 years—an increase of £1,050.

Under these conditions the junior executive on £1,000 a year, getting an increase in salary averaging 7½ per cent per year, would obtain a 25 per cent increase in standard of living during the next 25 years. This is small compared with the rise of 100 per cent expected for the average wage-earner.

Moreover, the £2,000 executive would suffer a 3 per cent fall in standard of living, and the £3,000 executive would suffer a 16½ per cent fall, in spite of the increase in personal and dependants' allowances. We thus see that increasing personal and dependants' allowances, to keep pace with the cost of living, does not prevent executive standards of living from falling relative to those of wage-earners.

Another way of looking at this problem is to consider the case of an executive whose present salary is £3,000, and who therefore pays tax at 12s. in the pound on any increase in salary. If we were to assume that over a period of years the price level were to be doubled, and personal and dependants' allowances were also doubled, then this executive's allowances of say £440 for himself, his wife and two children would double to £880. But by doubling the allowances, without altering the tax rates, he would merely be pushed £440 up the tax scale. Surely an executive who pays 12s. in £1 at the £3,000 level before prices double, should not pay 12s. in £1 until he reaches the £6,000 level, after prices have doubled. For every pound note becomes worth only half its former value.

One of the odd things about the effects of inflation and high tax rates on the standard of living of executives is that very few of them realise the *full force* of these effects. By their very nature, executives are optimistic people. They are always hoping that they will do better tomorrow. And of course there are some who obtain extremely rapid promotion which gives them the feeling that they are getting ahead of the cost of living, even if they are not.

How they have fared

In order to test how executives felt about the effects of inflation and high tax rates on their living standards, BUSINESS sent out a few private and confidential letters to readers, asking questions about the promotion they have received in recent years, increases in salary and consequent changes in standard of living.

Because figures can be so deceptive, the term "standard of living" was illustrated in a number of ways. For example, the readers were asked to give information about any change in their housing conditions, in their position as car-owners, and in some of the other typical attributes of middle-class life, such as their children's education, the type of holidays they have, their sporting activities and social life.

A depressing feature of the answers to these enquiries was that only one executive out of ten who responded really felt that his stand-

If he gets fairly rapid "promotion," the junior executive on £1,000 a year may be able to maintain his standard of living in the future — but is unlikely to increase it, unless inflation stops or tax rates are cut

The "star" executives who have already reached £2,000 or more by the age of 40, and who will lead the nation's productivity drive, can expect their standard of living to go down by from 20 to 30 per cent during the next 25 years, in spite of rapid "promotion"—unless inflation stops or tax rates are lowered

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ard of living had increased substantially in recent years. And he is the managing director of a large manufacturing company. Twenty years ago he was a district manager for the same company, and later a director.

During the last ten years alone his gross income has multiplied by four, and he considers that his standard of living has risen 2½ to 3 times. Statistically this does not seem possible, for prices have risen by more than 70 per cent, and he is in a high tax bracket. But clearly he is allowed more expenses than he was ten years ago, and much of the "fun" that he gets out of life comes through activities associated with his business.

Dreams Realized

Before the war he had an ordinary three - bedroomed suburban house, and now he has a rather large five-bedroomed suburban house. He used to have one Austin car, but now he has an Austin and a Sapphire. Before the war he was educating two children, but now they are "off his hands." This, no doubt, partly accounts for his feeling much better off.

Before the war he played practically no sport, and had very little social life. He spent a lot of time travelling and working very hard for promotion. His holidays then were the normal sea - side family holidays. Now he has his own cabin cruiser, and his two main sports are yachting and fishing. His social life consists mainly of business lunches and dinners, with a sprinkling of private theatre parties.

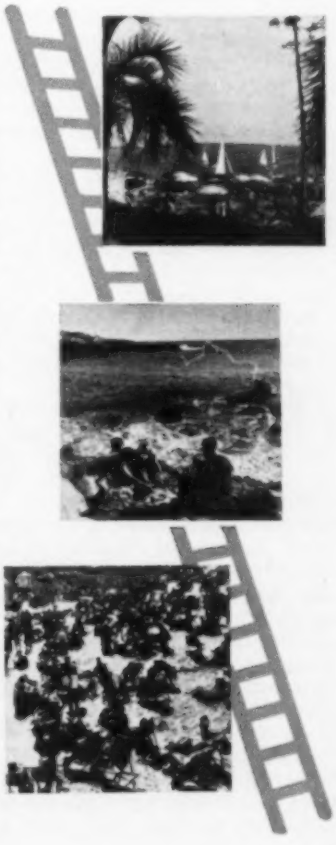
Clearly this senior executive has got to the position which nearly every junior executive dreams about. We have given at some length a rosy picture of his life because it must necessarily be followed by much gloomier stories.

2 Twenty years ago one of our readers was a tool-room foreman, and now he is the general manager of a subsidiary in a large manufacturing group. In the last 20 years his salary has risen ten-fold. He believes that his standard of living, after allowing for higher tax rates and rising prices, is now four times what it was in 1935. Statistically, his standard of living should really be only a little over twice as great as it was in 1935, but he himself comments that his high standard is "mainly due to appreciation of personal assets—for example, I purchased a small house prior to 1939 which appreciated in value during the war. It would be much more difficult for someone to try to establish himself after 1939, particularly if he was called up or if he purchased a house or car during the post-war years."

In 1935 the foreman had a little flat and a Ford 8. His children went to the local convent, he played cricket and his social life revolved around the cricket club and visits to and from relations. His holidays consisted of staying with relations. Now the general manager has a detached four-bedroomed house, he runs a Vauxhall and a Humber Snipe. His holidays are generally at South Coast resorts, and he is too busy to engage in any form of sport. He has a rather mixed social life, consisting of some private parties but mainly business functions.

3 Another of our readers was a sales representative immediately after the war, and he is now a director of the same firm. His salary has risen in 10 years from £650 to £4,800. He used to live in a three-bedroomed, semi-detached estate house, and now has a four-bedroomed detached house with three living rooms. He had no car immediately after the war, but now has an Austin A50. Even this is a second-hand car. He has one child at boarding school, and in spite of his high gross income he considers that he "cannot afford proper hotel holidays."

4 Another reader was a departmental supervisor in a factory immediately after the war, earning around £600 a year. He now earns around £2,000 a year as a factory manager. He considers that his standard of living has increased by 50 to 100 per cent, but this is mainly due to the fact that his wife is work-



It will require a substantial tax concession all the way up the scale to prevent a decline in executive living standards—unless inflation is stopped

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ing, and they have no children to cater for. They have very little social life. Immediately after the war they lived in a little maisonette, and now they have a large three-bedroomed house. They used to have no car, but now they have a second-hand 17 h.p. saloon.

5 A reader who was assistant secretary of a light-engineering firm immediately after the war, is now the comptroller. His salary has risen from around £500 a year to around £1,500, but he feels very little difference in his standard of living. He has the same small suburban house, but whereas formerly he had no vehicle, he now has "an ancient but reliable four-seater saloon." He feels that there has been "a lessening of austerity but affluence is still not yet in sight."

6 Another reader who in 1946 was a sales representative of a manufacturing firm, is now the advertising manager. His salary is now 2½ times its former level, but he still has the same three-bedroomed house, and the only appreciable change in his standard of living is that whereas formerly he had no vehicle, now he has an Austin A40.

7 One reader has had relatively little promotion in recent years. He was made an area-manager of his company immediately after the war, and is still an area-manager. But his standard of living has been partly protected by the fact that he receives a bonus on the profits of his area, and these have increased substantially. He still has the same four-bedroomed house in a good suburb, which he had built in 1935. He used to have a Riley, but now has a Daimler Conquest.

8 A clue to the deceptiveness of post-war living standards is provided by a reader who in 1946, after being demobilized, was a very junior sales representative but is now a sales-promotion manager. His gross income is now five times what it was ten years ago, and statistically his standard of living should be not far short of double that of ten years ago. But he says "it does not seem that way, possibly because of my army gratuity and the accumulation of salary from the company during war service."

Thus, by living on war savings, some post-war executives have given themselves an illusion of quite a good standard of living. But that phase is coming, or has come, to an end.

REPRINTS

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Immediately after the war this sales-promotion manager lived with his parents, and his wife lived with hers. Then they got a small two-bedroomed, sparsely furnished house, and now they have a four-bedroomed detached suburban house. They are educating one son aged eight. They used to have an old 1936-model Standard 12, and now they have an old 1936-model Morris 18. Their holidays are the same austerity holidays they had after the war, and most of the minor luxuries in the home were bought for cash after the war, but will in future have to be replaced through hire purchase.

This executive sees himself becoming more and more dependent on his firm for "escape" methods of increasing his standard of living, or at least maintaining it. For example, he is covered by a "top hat" insurance policy. For social life he and his wife are becoming more and more dependent on business entertainment, and although at present he supplies his own car, he would prefer a car supplied by the firm rather than an equivalent increase in salary, because of maintenance and running costs.

9 A reader who is now a company secretary and accountant was immediately after the war a ledger clerk. His salary has increased nearly four times, but he cannot afford to run a car. He and his wife lived with his parents in 1946. In 1949 they bought a small two-bedroomed terraced house, and last year they moved into a small semi-detached three-bedroomed house.

10 Another reader who was a junior order clerk in 1946, earning £260 per annum, now manages the office of a large professional firm, and has a salary of £1,200 per annum. He has no car, and has never owned one. Immediately after the war he shared a three-bedroomed suburban house with another family, but now he owns his own four-bedroomed suburban house.

Better Off Abroad

There are good grounds for being a little pessimistic about the future outlook for British business executives, when in fact they are more heavily taxed than any other executives in the world. Some idea of this can be got from the accompanying Table 1, which compares the amounts of tax paid on the equivalent of a sterling income of £1,000, £2,500, £5,000 and £10,000 in the United Kingdom, the United States and

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Germany, and three leading Dominions—Canada, Australia, and South Africa.

The rates of tax payable in the United States and Canada, as depicted here, are of course influenced by the necessity for taking an arbitrary exchange rate. It is widely accepted that the official exchange rate of 2.80 dollars to the pound does not provide a fair comparison of living costs and income levels. The rate usually taken for such comparisons is four dollars to the pound, and this has been adopted here.

It will be seen that only one overseas tax figure is higher than any of the United Kingdom figures. In Germany, on a £1,000 income, nearly twice as much tax is paid as in Britain. But as one goes further up the income scale, the tax rates in Germany and in all the overseas countries are notably lower than in Britain.

Depressing

Table 2 helps to highlight these comparisons by expressing the taxes paid in overseas countries, on a given level of income, as a percentage of the tax paid in Britain. Thus, every figure in the United Kingdom column of Table 2 is 100, and all the other figures for overseas countries, except one, are less than 100.

Taking the long-term view, one of the most depressing aspects of British tax rates is that they rise so quickly to a very high peak. On all income in excess of £15,000, the British executive pays a tax rate of 18s. 6d. in the pound, or 92½ per cent.

Actually the next highest rate is paid in the United States, where the top rate is 91 per cent. But this level is not reached until the income exceeds £75,900, and at the £15,000 level of income, the rate of tax payable on excess income is only 62 per cent.

In Canada, the top rate is 78 per cent, but this is only payable on income in excess of £100,000, and the rate payable on income above £15,000 is only 58 per cent. In South Africa, the top rate of income tax is reached fairly quickly—on income in excess of £9,300. But this rate is only 63 per cent, and it subsequently falls to less than 59 per cent when the total tax paid exceeds £6,000. In Australia, the top rate is 13s. 4d. in the pound, or roughly 67 per cent. This is payable on all income in excess of £12,800 sterling.

In Germany, the rate of tax paid on executive income in excess of £15,000 is 53 per cent. The rate rises to 63½ per cent on an income in excess of £51,500, but on all income in excess of £52, 250, the rate is only 55 per cent.

Clearly, British tax rates on executive incomes are so onerous that they are bound to affect incentives during the next generation. They are bound to discourage the key men who will be in charge of the drive for higher productivity.

It may be that inflation will be less in the next 25 years than it has been in the last 15 years. But we cannot be certain of that. What is needed is a lowering of the tax rates all the way up the scale. The provision of tax relief only at the bottom of the scale may be popular, but a "popular" policy is sometimes a very short-sighted policy, against the best interests of the very people who like it. Everyone may suffer if the tax scale is not re-modelled to provide reasonable prospects that the next generation of executives will be able to gain higher living standards as and when they are promoted to greater responsibilities.

Table 1

STERLING INCOME	TAX PAID					
	U.K.	U.S.A.	GERMANY	CANADA	AUSTRALIA	SOUTH AFRICA
£1,000	85½	59	169	67	84	22
£2,500	674	343	623	372	558	342
£5,000	2,199	1,031	1,993	1,270	1,797	1,327
£10,000	5,999	3,179	4,700	3,579	4,829	4,091

Table 2

STERLING INCOME	INDEX OF TAX PAID, TAKING U.K. TAX FIGURE AS 100					
	U.K.	U.S.A.	GERMANY	CANADA	AUSTRALIA	SOUTH AFRICA
£1,000	100	69½	199	79	99	26
£2,500	100	51	92½	55	83	51
£5,000	100	47	91	58	82	60½
£10,000	100	53	78½	60	80½	68

This New Building Promotes Staff Unity

As a trade and technical publishing house, Business Publications Ltd. and associated companies contain a large number of comparatively small units producing different journals, with the help of a common administrative service. In the company's old Fleet Street building, solid dividing walls created an atmosphere of isolation. But in the new building, in the rapidly developing printing and publishing area on the south bank of the River Thames, a new atmosphere of staff unity has been created by the skilful use of glass partitioning (7ft. high) and low partitioning (3½ft. high). Some features of the design are highlighted here

LIGHT AND QUIET. Although the partitioning does not extend to the ceiling, sound is deadened by the use of acoustic board on the ceiling and thermoplastic tiles on the floor. There is glass-wool in the lower partitioning. Separate departments are visible, but do not disturb each other.

Maximum daylight is available to all parts of the building. Artificial lighting is flush with the ceiling, and therefore easy to maintain and clean.

There is good ventilation, but draughts are unknown because the air-gap above the partitioning equalizes air pressures. An oil-fired, automatic boiler provides central heating, related to the outside air temperature by thermostatic control.

2 COLOUR AND CONVENIENCE. Note the dark wall on the right-hand edge of this picture. All walls are in light-reflecting pastel shades except for two on each floor, which are of a darker, contrasting hue. There is a different colour scheme for each floor, and this is identified on the stair landing. Doors are brightly coloured, to add a touch of gaiety.

Convenient cloak cupboards make it unnecessary to take coats into offices.

The L-shaped tile pattern on the floor was chosen so that it will suit any particular arrangement of the movable partitioning, should office reorganization be necessary.

3 'PENTHOUSE' MEALS. Double doors lead to the staff dining room on the roof, thus preventing cooking smells from penetrating the building. A sun terrace, with views over London, provides for lunch-time relaxation on that odd summer day.

4 SMOOTH-FLOWING ROUTINE. Although publishing is very much an individual art, some of the related work, such as handling readers' subscriptions, can be put on a flow-line basis. The layout shown here was introduced to replace the motley collection of desks and shelves used formerly.

This new system incorporates a central line of cupboards with *Formica* tops, along which documents may be passed from one clerk to the next. On either side are rows of specially designed desks, the two rows facing in opposite directions.

Whereas in most desks nearly half the space is wasted, these desks are designed so that each girl uses the front half of her own desk and the back half of the desk behind her. She has cupboards for her personal belongings, as well as for the different forms, files and machines required to handle about 80 per cent of the total number of stages of work involved. Thus the monotony of the work can be relieved by frequent changes of function, with little need for supplementing the supply of forms and equipment already available to each girl.

5 PRIVATE GOODS ENTRANCE. All departments receiving or sending bulky materials are, of course, situated on the lower floors of the building, and in contrast to the former "nightmare" of kerbside loading and unloading, the new building has been designed with a private drive-in yard, with direct access to the goods lift.

The earlier experience of Peter Gordon Masefield as a technical journalist contributed much to his success as chief executive of British European Airways. It gave him the ability to talk technically with the leading designers in the aircraft industry, and it also equipped him with the ability and enthusiasm to devise means of keeping all his employees informed of the progress and setbacks of the Corporation—an indispensable step in building up high morale and pride in a public undertaking subject to frequent ill-informed criticism. Mr. Masefield's abilities are now being put to a new test as managing director of Bristol Aircraft Ltd.

PETER GORDON MASEFIELD
An 'idealist' who became chief executive at 34

His 'RESTLESS DISSATISFACTION' Took Him to the Top

By PAUL NUGAT

A FEW men are born to leadership, but many men have to train themselves carefully to be chosen for it. Forty-one-year-old Peter Gordon Masefield, managing director of Bristol Aircraft Ltd., may be said to have been both born and trained for the job. He did not inherit a family business, but he did inherit a good brain.

Add to this a solid, professional middle-class background—his father was a well-known doctor—and an education which took him from Westminster School to Chillon College in Switzerland. There he filled in a year before going up to Cambridge to take a degree in aeronautical engineering.

His interest in aeroplanes began in early childhood. By the time he attended the Olympia Air Show at the age of 15, he knew that he wanted to carve a career in British aviation. At 21, he was academically equipped to start.

His first job was on the design staff of the Fairey Aviation Company. But after some two and a half years, Mr. Masefield felt that the job was too confining and looked around for fresh pastures.

Later on in his career he was to use the phrase "restless dissatisfaction" frequently in his writing. Actually, it has always been a strong trait in his character—as has been his hunger for any knowledge which would broaden his experience of the aviation industry.

For a number of years, even before he went up to Cambridge, he had maintained a lively correspondence with C. G. Grey, editor of *The Aeroplane*, so that when Mr. Grey offered him the opportunity of joining the editorial staff as a technical assistant he immediately accepted. Two years later he became technical editor.

Six years in aviation journalism—three of which coincided with the war—set the seal on his future career. He acquired a first-hand knowledge of the aviation industry, such as only a gifted, specialized journalist is in a position to acquire. The war also brought him a second assignment, as air correspondent to the *Sunday Times*. He saw service as a war correspondent with the U.S. 8th Army Air Force, and his despatches were very well received.

Recognition followed when he was appointed personal adviser on civil aviation to the Lord Privy Seal, Lord Beaverbrook, and secretary of the War Cabinet Committee on Post-War Civil Air Transport. From Lord Beaverbrook he learnt never to give "No" as the answer to a request just because it was far easier than to say "Yes."

Most born leaders seem to have one characteristic in common — the capacity to handle a number of auxiliary jobs in addition to their main work. Mr. Masefield runs true to type. Years before the Government came to appreciate the importance of aircraft recognition, Mr. Masefield had found a serious outlet for this hobby of his in training members of the Royal Observer Corps. During the war he became chairman of the editorial committee of *The Inter-Services Journal on Aircraft Recognition*. Today, this is once again a hobby he shares with his three sons.

At the end of the war, Mr. Masefield was selected to be the occupant of two new posts. First, he became the first Civil Air Attaché at the British Embassy in Washington for

- **In six years Mr. Masefield never missed writing his monthly "Chief Executive's Page" in the** *B.E.A. Magazine*

two years; then he was appointed Director - General of Long - Term Planning and Projects at the Ministry of Civil Aviation. Having spent two years profitably studying the American scene, nobody knew better than he the arrears that Britain would have to make good, if she was going to compete successfully.

Some idea of the near-visionary qualities demanded of aviation experts in their long-term planning can be gathered from the fact that, some seven and a half years after Mr. Masefield left the Ministry to become Chief Executive of British European Airways, there is no aeroplane in service which was not already at some stage of planning and development during his term of office.

In retrospect, it is apparent that Higher Authority had "earmarked" Mr. Masefield for the B.E.A. appointment and deliberately groomed him for it. Few men at the age of 34 are ready to shoulder so much responsibility. Lord Pakenham, the then Minister of Civil Aviation, personally made the appointment.

After the war B.E.A. had no immediate hopes of new aircraft to replace the obsolete, converted military machines. One of the first tasks Mr. Masefield had to perform was to wield the axe rather severely. B.E.A. was operating heavily "in the red," and the immediate expectations of revenue did not justify a payroll of 10,000 employees. Never a pleasant task for any boss, it was even more unpleasant for a new boss intent on dedicating much of his enormous personal energy to the task of creating team-spirit.

Many firms have grown to great size on the strength of good working relationships. To them, team-spirit is something that you have to maintain but do not have to create. It is a very different matter when there is already a large organization in existence with its personnel spread all over the map—from the Shetlands to Istanbul—a personnel much in the public eye and at the receiving end of a lot of ill-informed and unfair criticism; a personnel with a low morale, inadequate equipment and a corresponding standard of efficiency.

Into this situation Mr. Masefield injected no miraculous new system. What he did do was to apply the proven benefits of joint consultation and continuous communication with a verve and sincerity which was infectious and irresistible. The highlight of his work in this field has been the monthly "Chief Executive's Page," a double-page spread in the B.E.A. Magazine, which sells over 8,000 copies at 3d. to some 9,000 employees.

A recent ballot to determine the most popular features in the magazine put this feature with 52 per cent at the top of the poll, leaving the remainder as "also rans." This tribute to Mr. Masefield is not surprising. There is no house magazine, to my knowledge, which has ever set out to take employees so completely into the confidence of the management. Open any issue of the magazine and there, in the lucid style of the good journalist, are set out statistical data on every aspect of running the company, with comment and interpretation which assumes an intelligent readership.

- **He gets by on four or five hours sleep, provided he has one long night in the week**

In the first of his monthly articles, Mr. Masefield made plain his intention: "In the past there has been, I think, something of a tendency to wrap up civil aviation in an air of mystery and even of secrecy. There is no reason for such an attitude."

Such a verdict is dearly loved by members of any organization. It is a promise which has to be made good all the time or is better left alone. Mr. Masefield never missed writing his monthly feature in the course of six years. That in itself is not remarkable. But, when one reads any single feature, one can appreciate how clearly every facet of B.E.A.'s activities was at his fingertips. On one occasion, at least, the article was written flying the Atlantic.

In attempting any sort of description of Mr. Masefield's working day, the picture is certain to look hopelessly overdrawn. In his own words: "I get by on four to five hours sleep, provided I have one long night in the week."

So, long before dawn a light burns in his study in his house at Reigate. (He finds that he cannot work much or well after 11 p.m.) Breakfast is accompanied by a critical glance through the newspapers. Any unjustified comments, correspondence, etc., in the Press will be summarily dealt with, as he drives as fast as conditions permit to his office. The problem of driving and dictating a sharp retort to a newspaper or a memo to somebody has been solved by installing a dictaphone in the car and wearing a throat-type microphone.

Now at Bristol, Mr. Masefield arrives just after 8 o'clock each morning, and his private secretary, too — the rest of H.Q. staff being due later. The official day begins with a conference with departmental heads. Mr. Masefield believes strongly that six heads are the upper limit if the accumulation of daily problems and developments are to be

Never too busy to be "on the spot"—Peter Masefield visits the cockpit of the B.E.A. entrant with Captain W. Baillie before the England - New Zealand Air Race, October 1953

tackled and despatched. In these daily conferences—from 8.45 to 9.30 a.m.—much of the close and careful inter-personnel communications start on their downward journey.

The daily conference over, Mr. Masefield may just find the time to deal with his most urgent mail. One of his rules is that any letter addressed to him will be answered by him—the information for his reply may, of course, have been supplied by the department concerned. Such is the scale of his correspondence that it takes one secretary one hour every morning to open the mail and stamp it. Thus, in the B.E.A. days, if Aunt Hester dashed off an abusive letter, in a heated moment, swearing that she'll never fly B.E.A. again, the complaint was investigated and either the true facts explained courteously or a profound apology made. In either case, she would receive a personal letter from Mr. Masefield.

However, much of Mr. Masefield's time was taken up with the forward planning of B.E.A.'s requirements. Forward planning in civil aviation means looking ten years ahead. It means being able to forecast the public's expectations of air travel, which entails both vision *and* keeping a sharp eye on the balance sheets of future years.

While this burden did not fall upon Mr. Masefield's shoulders alone, he has certainly made a vital contribution to its solution. The strength of his contribution gains much from the fact that his training as a designer enables him to hold his own in technical conversation with the best designer or stress-man in the aircraft industry; and the manufacturing industry is greatly dependent on the findings of commercial air operators for its knowledge of future trends.

Mr. Masefield's second major asset is his flair for creating a clear-cut picture out of the most unpromising and perplexing sets of statistics.

The boardroom of B.E.A., incidentally, was hung with graphs inspired by him, which to a board of part-time members, with the exception of the chairman and chief executive, must have been an invaluable aid in keeping everybody abreast of rapidly changing developments.

To return to Mr. Masefield's working day. Somewhere between consultations with Government officials and with members of the aviation industry, he found time to attend the panels or joint councils, through which the 16 trade unions represented in B.E.A. negotiate wages and work-

- **The problem of driving to the office, and dictating at the same time, has been solved by installing a dictaphone in the car and wearing a throat-type microphone**

ing conditions. Mr. Masefield made no secret of his hope that eventually the panels would broaden the scope of their discussions—"not merely as negotiating machinery but even more as a means of two-way interchange of ideas on both management and staff problems."

A temporary set-back to these hopes was the strike known as the "Peters case." Mr. Masefield felt this incident very personally. He is an idealist, believing with unusual intensity in the principles of democracy. And like all idealists, it is a painful jerk to discover how easily people can be led to disrupt the working of these principles.

One of Mr. Masefield's regrets on leaving B.E.A. was that he had not been able to find the time to get about as much as he would have liked to meet his staff. Nevertheless, the staff could never be sure where and when he would show up. It was by no means rare for him to visit the night staff on duty at an airport, after having worked until 7 p.m. (his usual hour) at the office, attended an official dinner or delivered a paper at a conference.

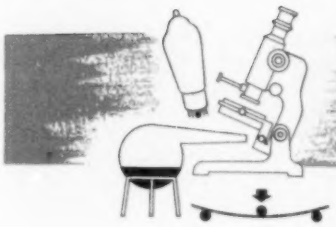
In the cause of British aviation, no request for his services goes unheeded. A very good speaker, he has espoused the cause of British aviation as effectively in America as in Britain.

Driving himself ruthlessly, he is the exact opposite of the tycoon who is so often cartoonized as driving everybody else ruthlessly. Certainly, Mr. Masefield has always demanded from his staff a straight answer to a straight question, and those who have attempted to procrastinate have found that it did not pay. But whatever driving has had to be done has been tempered with good humour and an appreciation on the part of the staff that the demands he has made on them are nothing compared to the demands he has made on himself.

Those demands have meant the virtual denial of any private life, of any interests outside aviation. In six years, he has had one holiday. The pleasure of flying his family of four children to Majorca last year, lazing in the sun for a long week-end at the end of their holidays and flying them back home, was his idea of a holiday.

Most men, after driving themselves so hard for so long, would have been happy with the thought that, having piloted a ship as large as B.E.A. into a more prosperous position, they could at last relax and enjoy the fruits. Nothing is more typical of Mr. Masefield than that, at the moment of success, he should choose to become managing director of Bristol Aircraft Ltd., thus ensuring for himself a further long period of toil.

The Bristol Britannia



SCIENCE PROSPECT

PLAIN MAN'S GUIDE TO NEW TOOLS AND TECHNIQUES

'Programmed' Machine Tools

HOW THEY SPEED UP— 1 DEVELOPMENT WORK 2 TOOLING-UP 3 SHORT-RUN PRODUCTION

PETER SPOONER Launches a New 'BUSINESS' Series with this Special Survey

Now coming into workshop service are automatic control systems which enable a machine tool to make a variety of parts from master sets of instructions encoded on punched paper or magnetic tape. This article describes—in non-technical language—how they work, and discusses their implications for firms of all sizes.

ONE of the more promising developments of the Automation Age is the electronically "programmed" machine tool, capable of making parts automatically when a set of instructions, prepared from drawing office information, is fed into its controls. A few machines of this sort are already in workshop service, and during the next ten years the systems which they represent will undoubtedly influence production methods in many factories.

How much influence—and in what form? To say that programmed machines will eventually make up the production lines in large robot factories is neither helpful nor accurate. So BUSINESS has prepared a plain-language survey of these developments which assesses their value in more realistic terms.

What They Do. Electronic programming means that a standard machine tool equipped with special control gear can undertake any sequence of operations which its design permits *without* calling on the skill and experience of a human operator, and *without* using jigs, templates or masters. Setting up is so quick—after the master set of instructions have been prepared in a separate operation outside the workshop—that the automatic production of small batches and even one-off parts becomes economically possible. The work may involve machining in one, two or three dimensions; it may be a simple task or one which would present difficulties if conventional methods of control were used.

How They Work. Dimensions and other information supplied by a planning engineer are punched into a strip of paper tape and fed into an electronic unit. This computes the series of machine movements which are needed to produce the specified work.

In two of the systems described in this article, the computed instructions —expressed in the form of electrical signals—are recorded on a multi-channel magnetic tape. When the magnetic tape is run through a control unit attached to the machine tool, the signals operate the machine's slides, etc. through servo-motors and other electro-mechanical devices.

The tape can be used time and time again to produce any number of identical parts. Meanwhile, the computing unit — situated outside the workshop—can be preparing tapes for other parts.

In the third system described here, the computing devices are actually incorporated in the machine tool controller, and command signals are fed straight into the servomechanisms which direct the machine's movements.

Who Will Use Them. An apt description of machine tool programming is "short-run mass-production." A report by the Massachusetts Institute of Technology, where the possibilities of what the Americans call "numerical control" have been under investigation for more than five years, says that it "extends the benefits of automatization to moderate-volume industries previously limited to manual methods of production."

Much of the activity has been aimed at the manufacture of complicated aircraft parts, for here, indeed, is an industry in which the difficulties of short-run production and fast-moving development work are encountered in a particularly intense form. But it would be wrong to assume on this evidence that the use of numerically-programmed machine tools will be restricted to a few firms

SCIENCE PROSPECT

with special manufacturing problems. *Even in mass-market industries* — where conventional forms of automatic control already fill the bill in most respects—*there are many promising applications.*

On three types of engineering work the advent of numerical programming will have far-reaching effects. They are:

1—The manufacture of prototype parts for use in development programmes.

2—The manufacture of tools and templates for use on mass-production machines.

3—Die-sinking — a specialized branch of toolmaking which often forms bottlenecks in a company's manufacturing programme.

Every manufacturing business is interested in at least one of these three operations. Certainly there is evidence that the effects of this new form of automation will be felt in small precision workshops as well as in large factories.

Compare numerical programming with other forms of automatic control. The principle is quite different. In this difference lie some big advantages.

For many years machine tools have been capable of working automatically under the control of cams, templates, limit stops, metered hydraulic systems and other built-in devices. Such equipment, which has reached a particularly advanced form in the much-publicized transfer machine, is dependable and efficient when large numbers of identical parts are needed. On economic grounds alone, programmed machines have very little chance of ousting conventional automatics from their place in the mass-production line.

But the tables are turned when small batches of identical parts are needed. Changing a conventional automatic from one pre-set cycle to another is a complicated and expensive business, almost invariably out of the question unless it precedes a long, continuous run. In some cases, only one motion of the machine is controlled automatically, so a complete machining operation may involve a number of different set-ups, each of which is time-consuming and costly.

More advanced work—in either two or three dimensions—can be produced automatically on tracer-controlled copying machines. In this case a stylus moves over the surface of a "master" part (made on a manually - controlled machine) and directs the motions of the table on which the new workpiece is set up. The result is an exact replica (within reasonably small tolerances) of the original.

During the past few years there has been much progress in the copying machine field, aided by the development of electronic tracing systems. But problems still arise when only a small batch is needed: the expense of producing the master may represent a very large percentage of the cost of each finished part, and may even make the whole operation unprofitable.

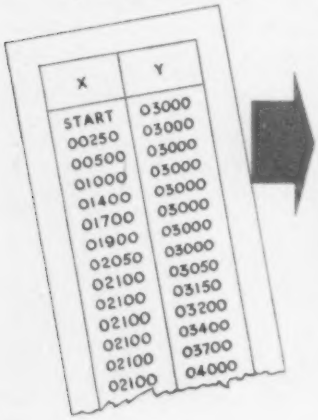
Masters are expensive because the man who makes them is incapable of using more than a fraction of his machine's capacity. For much of the time he is interpreting the information on a blueprint, transferring it to the machine's feeds, and checking and cross-checking his own work. Because he has difficulty in co-ordinating two or three simultaneous feeds, he is compelled to stop at frequent intervals to adjust the work or the machine, and to check dimensions.

This is where programming systems step into the picture. Once a set of instructions has been inserted, the machine can *work continuously at its most efficient speed.* Often the whole job can be done without changing the position of the workpiece on the table.

In its present form the programmed machine tool cannot produce anything more complicated than the sort of work which can be reproduced from "hand-made" masters on conventional copying equipment. Although it scores in some respects (dodging, for example, the difficulties which occur when a stylus has to follow an awkward shape, and the slight loss of accuracy which copying entails) such advantages are marginal. Its real value lies in the fact that high productivity and precision are combined with exceptional flexibility.

▶ Switching a programmed machine

1—*This picture story shows the E.M.I. machine tool control system in action. The operation—milling an irregularly-shaped channel in the face of a metal plate—starts with a table of dimensions specifying a series of discrete points, at intervals of about ⅛in., on the proposed cut. Such information comes straight from the design office*



X	Y
START	03000
00250	03000
00500	03000
01000	03000
01400	03000
01700	03000
01900	03000
02050	03000
02100	03050
02100	03150
02100	03200
02100	03400
02100	03700
02100	04000

2—*A typist punches the dimensions into standard teleprinter tape. At the same time, a printed record is produced. Punching errors are corrected by back-spacing and pressing a special key*

3—*The tape is threaded into the reading head of the control unit. The unit will read off the specified points, compute a smooth path through them and pass "instructions" to the machine*

tool from one job to another involves little more than inserting a new tape. More than any other type of equipment, it approaches the production engineer's conception of a truly "universal" tool.

▶ Machine instructions for making a large number of different parts can be filed in a compact form; no capital is tied up in templates and masters. The instructions do not deteriorate with age, and amendments can be made if the designs are changed subsequently. They can be sent by post from one factory to another, and even transmitted over ordinary teleprinter lines.

What this flexibility means in practice depends on the requirements and working methods of the firm which adopts numerical programming. In one case the ability to make prototypes more quickly may be all-important; in another it may cut very little ice. One firm may be influenced entirely by the fact that machine utilization in the toolroom is increased; another may find that the ability to make small batches economically opens up business opportunities which are at present unprofitable. No rules-of-thumb cover the installation and use of programmed machines. Here are some *possible* advantages:

1 — Development programmes will run more evenly. The work of a team of engineers will not be held up (and the men dispersed, perhaps, on to other jobs) while newly-designed parts are made.

2—It will be possible to make changes during a production run without scrapping expensive templates or waiting for the toolroom to machine and set up new ones.

3—Replacements for obsolescent or rarely-wanted parts will be made as and when they are needed. Firms which market a large number of different components will be able to maintain a reputation for prompt after-sales service without holding excessive stocks.

4—Work planning in toolrooms and jobbing workshops will be simplified by virtue of the fact that a programmed machine's output can be predicted much more accurately than the output of a machine controlled by an operator.

The Computer's Role. Numerically-controlled machines are often described as "computer - controlled." This term is inaccurate in some respects and misleading in others. Inaccurate because programming calculations usually take place in a self-contained operation outside the control and machining area. Misleading —at least to the layman—because the word "computer" is identified with "electronic brains" and its use gives the impression that the skill and judgment of a man drilling holes in a metal plate is being replaced by something as big and versatile as *Leo*.

An electronic digital computer is not an essential component of machine tool programming systems. Although the preparation of the punched or magnetic tape which tells the machine how to behave may involve a lot of arithmetic, all of it could be done (and sometimes is done) on slide-rules or desk-calculators. The main thing is that the machine is controlled by signals presented to it in a pre-determined sequence, and by additional signals generated automatically as the equipment checks its own performance.

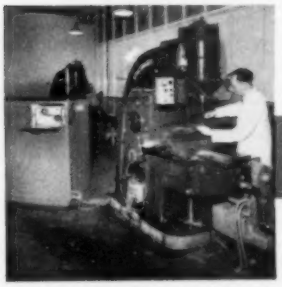
Nevertheless, electronic computing plays an important part in most systems. Its value lies in (1) the speed with which it can handle complicated figurework and (2) the fact that it eliminates repetitive calculations.

The second of these accomplishments is the more important. By using a system of "sub-routines," a planning engineer can draw up programmes for a variety of jobs without having to solve virtually the same problems time and time again.

A "sub-routine," for example, may represent the method of calculating the precise path of the cutting tool when the designer has indicated that an ellipse is required between two specific points. The planner has merely to feed into the computer the appropriate dimensions and (by means of a code) the type of curve: the rest is automatic. Other sub-routines may cover such operations as milling square or triangular recesses in the face of a workpiece.

This method of short-cut programming is associated with all forms of electronic data-processing. There are two ways of using sub-routines. Either they can be recorded on punched cards or tape and held in an external file, from which they are drawn when new programmes are prepared; or they can be "built into" the computing equipment itself.

In much of the development work which has taken place in the U.S.A., the emphasis has been on the use of standard engineering-type computers at the tape preparation stage. British manufacturers have favoured the other approach. One of the available systems employs a special-purpose electronic computer with built - in sub-routines covering most of the curves, etc. which are encountered in ordinary engineering work. Another



4—An attendant sets up the work on the table of the machine — a modified Cincinnati vertical miller fitted with servo-motor control gear. From now on the operation is entirely automatic

5—Signals from the control unit tell the machine what to do. "Position identifiers" on the leadscrews check that it does it correctly. This was a test job—a piece of automatic doodling. It could be a cam guide. The tool milled out the channel continuously in less than ten minutes

system incorporates an analogue computer based entirely on electrical circuits. (The term "analogue" signifies that numerical input information is converted, for the purpose of the computing, into physical quantities—such as lengths or shaft rotations — the arithmetical operations being carried out by the direct physical addition, subtraction, multiplication or division of two such quantities.)

How Accuracy is Checked. Most machine tool programming systems have one thing in common. When they give the machine an instruction, they try to make sure that it is carried out properly.

Measuring devices continuously check the machine's movements and "report" to the control unit. The unit automatically corrects discrepancies between the instructions and the results which are being obtained.

This process is known as "closed loop" or feed-back control. A commonplace example is the thermostat in a domestic water-heating system.

On simple machines like capstan lathe, the surface of the work itself can be measured a short distance after it has passed the cutter. On more complicated machines the appropriate surface is obscured by the cutting tool. So a compromise is struck by measuring the position of the table on which the work is set up.

This can be done in several ways. Undoubtedly the simplest method is to connect some form of gauge to the leadscrews which move the table. One advantage is that it is making use of devices which are already incorporated in the basic machine; another is the relative ease with which even a fractional rotation of the leadscrew can be made to generate an electrical signal.

For most engineering work, the leadscrew method of gauging is sufficiently accurate; tolerances of one or two "thou" can be maintained if the machine is in good condition. But when a high degree of precision is needed, there are several drawbacks, caused mainly by inherent inaccuracies in the machine's moving parts. One of the worst enemies is backlash.

Another system, embodied in the M.I.T.'s numerically-controlled milling machine, uses independent rack-and-pinion gauges. Such devices can be made with great precision and do not have to carry the heavy loads which are imposed on leadscrews. Of course, they are still liable to be affected by wear, dust, and other factors.

In Britain, Ferranti Ltd. have developed an optical measuring system which employs defraction gratings produced at the National Physical Laboratory. These gratings are ruled with very fine lines. One piece is attached to the work-table, another to the bed of the machine. The two pieces are set at a slight angle, and when the first moves in relation to the second, a beam of light shining through them produces a series of pulses which can be read and counted electronically.

A gauging system which combines optical and mechanical measuring devices has been developed at the Mullard Research Laboratories, where research into the automatic control of machine tools has been in progress for some time.

In all these systems it has to be assumed that the position and cutting characteristics of the tool itself are constant. In fact, they are not. The advent of numerically-programmed machines has already set in motion new lines of research into various aspects of metal-working, including the effects of tool wear on cutting accuracy. Eventually, this research will lead to the development of more precise automatic gauging methods.

One point should be emphasized. The electronic unit which issues the instructions is invariably more accurate in its work than the machine which receives them.

Programming in Action. Virtually all machine tools can be placed under numerical control. The systems fall naturally into two groups:

Automatic positioning systems provide a swift and accurate method of setting up a series of positions on machines like jig-borers, drilling machines and capstan lathes. The co-ordinates of each position can be inserted manually by means of dials: alternatively, a series of co-ordinates can be fed into the control unit on punched cards, punched tape or magnetic tape. In every case, the position taken up by the table is checked and corrected automatically.

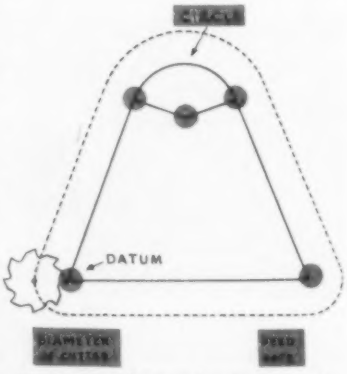
The punched card method is used in the automatic positioning system which the British Thomson-Houston Company have already applied to a large horizontal borer. Ferranti Ltd. have also developed control equipment of this type.

Automatic contouring and profiling systems issue table-positioning instructions in a continuous stream. Therefore they permit machining operations, like milling and grinding, where the shape of the finished part depends on the continuous movement of the table in relation to the cutting tool's centre.

Three-dimensional work can be produced on a two-dimensional machine if the programme instructs it to cut a series of complete contours and to make an adjustment in the third dimension at the end of each of them. From a succession of circular cuts, for example, it is possible to produce a cylinder, a cone or a dome; the same principle can be applied to some irregular shapes.

Some systems are capable of controlling the position of the cutter in three dimensions simultaneously. This might be described as four-dimensional working, because the process of initiating, checking and correcting three separate machine motions has to be synchronized with split-second accuracy if the cutting tool is to produce the exact shape specified in the programme.

Development work is being carried out in Britain, the United States and some Continental countries—notably



How the machining of a simple cam is planned (see next page)

Germany. Some of it is being conducted for their own purposes by aircraft manufacturers and other firms. By picking out the main features of three commercially-available systems which have gone or are on the point of going into workshop service, this article shows how the problems of machine tool programming are being approached in different ways.

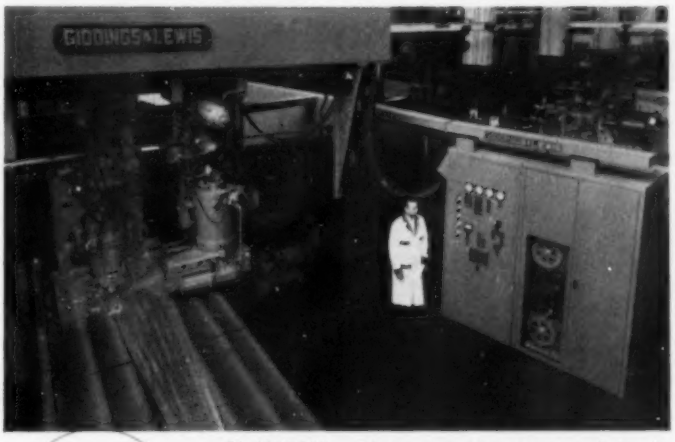
The Ferranti Research Laboratories at Edinburgh began a long-term development programme in 1952 — *one incentive being that the production of complex tools and prototypes in small quantities raised particularly acute problems in their own workshops. Although their system is not being used on a production basis at present, a number of installations will be made this year. Initial applications will include:* (1) *milling aircraft engine parts;* (2) *drilling heat-exchanger plates and* (3) *machining prototype parts for use in development programmes.*

The system is capable of controlling machining operations in either two or three dimensions. It works like this:

The part is designed and a drawing is made in the usual way. It is dimensioned, however, in a form which suits the computer. "Key" positions on the profile are specified in relation to the point at which the cut will begin. Basically, they represent the points of change—where, for example, straight lines are joined by a radius. Between such points only the type of curve required has to be specified.

Now the planning engineer takes over. He knows the capabilities of the machine and the best way of producing the work. While transferring the dimensional information to a standardized planning sheet, he interpolates other machining information, including the radius of the cutting tool which suits the job, the speed at which it should rotate, and the speed at which the feeds should operate.

A diagram on the opposite page shows how the machining of a simple two dimensional cam is planned. The dimensions and other information which have to be specified on the planning sheet are picked out in red.



PLANNING. Above—magnetic tapes used in the Numericord control system are prepared outside the workshop.

CONTROLLING. Below—As a tape runs through the control unit, the machine automatically produces an integrally-ribbed skin for an aircraft elevator

The dotted line is the proposed path of the cutting tool's centre.

Using a teleprinter, a typist (with no engineering knowledge) converts the basic planning information into a short length of punched paper tape.

The electronic computer comes into the picture at this point. Ferranti use a special-purpose machine which is considerably less complicated than, for example, their own "Pegasus" mathematical computer. Its job is to extend the simple information on the planning sheet by filling in the gaps between the points of change and thus calculating the continuous path of the cutting tool in all dimensions.

A number of sub-routines are built into this machine, enabling it to deal automatically with any curve—circle, ellipse, parabola, etc.—which is likely to be specified in ordinary engineering work. More complex shapes are specified in terms of ordinates; the computer will produce a smooth curve through these points.

A magnetic tape records the result of the computer's calculations, which are expressed in the form of electrical pulses. The tape has four separate channels, one for the feed in each dimension and one for other machine instructions. Each pulse represents a fractional movement of the cutting tool (say, one tenthousandth of an inch) in relation to the work. Therefore the number of pulses in each channel controls the distance which the cutting tool travels in the corresponding dimension, and the pulse-rate determines the speed at which it travels.

Finally the tape is fed into a control unit attached to the machine tool. This sorts out the pulse trains and translates them into accurate movements of the machine's slides. Dis-

crepancies between command signals and the positions taken up by the slides are cancelled out by a feedback control system employing the diffraction gratings mentioned previously.

The planning and preparation of tapes is done right outside the workshop. Because of the high speed of electronic computing, tapes can be recorded at ten times the speed at which they are normally played back. This means that one computing unit can prepare tapes for a large number of machines equipped with the special control gear. Making a cautious estimate in the absence of full operational experience, Ferranti suggest that a ratio of one computer to 50 machine tools would be appropriate in a workshop where the number of identical parts in each batch averages five.

In their own workshops, the system has achieved some remarkable savings. For example, a wave-guide assembly consisting of two light alloy blocks, one with an accurately milled track and the other with a mirror image of the same track, represents two weeks' work by a skilled operator using a conventional vertical milling machine with a rotating head. To plan, compute and machine both blocks on a programmed machine takes one hour. This includes 30 minutes' machining time, a figure which could be reduced to one-third by using a high speed routing head.

A system which Electric and Musical Industries Ltd. have been developing for some time made its workshop debut a few months ago, when a modified copy-milling machine equipped with special control gear was installed at the Norwich factory of Laurence, Scott and Electromotors Ltd.—probably the first time that a completely automatic programming system had moved outside its manufacturer's own establishments. Recently, another set of equipment was delivered to the Bristol Aeroplane Company. Further developments are in hand and will be accelerated no doubt by the agreement which E.M.I. made last year with the Cincinnati Milling Machine Company of America.

Ferranti control unit for a milling machine. It handles magnetic tapes prepared by an electronic computing unit

In two respects, the E.M.I. method of controlling machine tools differs substantially from the system described above.

First, the information on the control tape is nothing more than a series of discrete points, usually about ⅛in. apart. The path of the cutting tool is computed while the work is actually in progress — the computing system is part and parcel of the control unit. The equipment can undertake short-run production work on its own account or it can make masters for use on standard copying machines.

Second, the system employs an analogue method of computing. Instead of being converted into a train of pulses, the numerical information on the tape is simulated by electrical voltages. One advantage of using voltages as analogues lies in the ease with which they can be combined and modified through transformers and other relatively simple electrical units. Moreover, the resulting voltages can be amplified and fed directly into the servo motors which control the machine's movements.

This method of control has been made possible by a new technique which enables voltages to be manipulated with an accuracy of at least one part in 50,000.

The sequence of a typical machining operation is shown pictorially on pages 90-91. Programming is relatively simple, and no special skill is needed. The specified points, in whichever system of co-ordinates suits the machine, come straight from the part-drawing or from the table of dimensions which is normally prepared before a drawing is made. In determining the spaces which can be left between these points the programmer has to take into account the nature of the work, the most efficient feed-rates, and the degree of accuracy required. On sharp "corners," for example, more points are specified than on gentle curves.

Punching this information into standard teleprinter tape is a routine operation.

As the tape passes slowly through the reader, at a speed controlled by the machine's cutting speed, the specified points are read off in their correct sequence. To produce an accurate profile, an electrical device known as an interpolator "considers" several points simultaneously and deduces the path which will pass smoothly through them. While the analogue computations are being made, the appropriate points (more precisely, the voltages which represent them) are held in an information store consisting of standard relays. The only "electronics" in the system are valve amplifiers.

One paper tape can be played back at least 100 times. Duplicate tapes can be made quickly and cheaply from the original table of dimensions if a longer run is needed.

In its present form the E.M.I. control system is being applied to two-dimensional milling machines. Nevertheless, it is capable of controlling three-dimensional work without fundamental changes and, in fact, some applications have been carried out experimentally in the manufacturers' own workshops.

Feed - back control is obtained through a "position identifier" on the leadscrews. This simple arrangement gives a reasonable degree of accuracy in the finished part, although it is considerably less than the intrinsic accuracy of the instructions provided by the control unit. For work which justifies more complicated arrangements, the company

are developing gauging devices which are less affected by backlash and other imperfections in the machine itself.

The original installation at Norwich is of a highly specialized type, a control unit having been coupled to a precision copy-milling machine already equipped with an excellent servo control system. It is employed on the production of special two-dimensional cams.

In the past the production of one master cam involved drawing office and machining time amounting to a period of *between five and six weeks*. Now the whole operation, from the moment that the table of dimensions is passed to the teleprinter operator, takes *two hours*. Of this only 30 minutes is actual machining time. Moreover, all parts are made to the same degree of accuracy, without the slight loss which inevitably occurs when a master is copied.

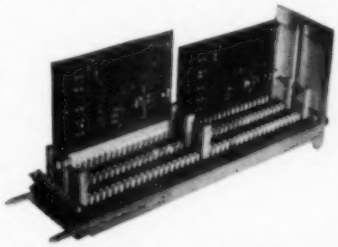
The control unit is capable of working out auxiliary information. At Norwich it automatically varies the speed at which the worktable rotates, thus maintaining the cutting speed at an optimum level irrespective of the radius of the work.

In the new installation at Bristol, the basic machine is a Cincinnati vertical miller, modified for automatic control by removing the hand controls and fitting servo motors to the leadscrews. Its initial applications will include toolmaking.

The Numericord system, made by the Giddings and Lewis Machine Tool Co., Wisconsin, U.S.A., is the outcome of sponsored research at the Massachusetts Institute of Technology and allied research by the General Electric Company. It appeared on the American market about eight months ago, and a number of installations have now been made. Available (but not yet operating) in Britain, it can be applied to most machine tools. The manufacturers say that the highest degree of efficiency is achieved when it is used on variable-axis three-dimensional contouring machines making large and complicated parts.

Using a 14-channel magnetic tape, this system can control as many as five simultaneous motions of the machine's slides or toolheads, and up to 22 auxiliary machine functions, including lubrication and chip removal. The tape can include audible signals, warning the machine's attendant that automatic tool-change and inspection stops, written into the programme, are about to come up.

Information for the programme is calculated from part-drawings and other sources. Ordinary calculating machines are generally used in this connection, although more complicated calculations are sometimes handled by standard engineering-type electronic computers. Before the raw information becomes, in effect, a finished part, it passes



This form of construction simplifies the maintenance of the electronic equipment. A plug-in tray—with six "circuit cards" —used by Ferranti Ltd.

through five units. These are:

First, the tape preparation unit. The operator enters information specifying fractional movements of the machine's slides and toolheads (and the "time intervals" which will co-ordinate these movements) on a keyboard, producing a master punched paper tape.

Second, an electronic computing "director." This converts the master information, which is in the form of decimal numbers, into synchronized command signals.

Third, a recording unit, through which these signals are marshalled into the appropriate channels of the magnetic tape.

Fourth, a playback unit, which reads all fourteen channels of the tape simultaneously and transmits the signals to the machine tool.

Fifth, a series of electro-mechanical units which translate the signals into actual machine movements. The feed-back control system is based on the use of rack-and-pinion measuring devices, operating in each machine axis.

Normally the tape preparation, computing and recording units are situated outside the machine shop. They may represent a planning centre for the production of one-off and short-run parts on machine tools of various types and, perhaps, in various locations.

The programmer must possess a sound knowledge of the machine's characteristics, metal-working processes, and mathematics. If an electronic digital computer is used during the initial calculations, it can be equipped with a punched tape output device, thus eliminating the manual preparation of a master tape.

Inherent accuracy of the magnetic tape signals is under five tenthousandths of an inch, which allows parts to be made to an accuracy of between one and two thousandths of an inch.

At one demonstration last year, the Numericord system was applied to an aircraft-type spar and skin milling machine producing jet plane skin and wing panels from solid aluminium plate. On work of this nature the manufacturers believe that the system can reduce by *at least* 50 *per cent* the machining time when manual methods of control are used.

The machine control portions of the system can be used "in reverse" to produce magnetic tape recordings while the machining operations are controlled by a template, or while an experienced operator either makes the initial part or goes through a "dry run." From these recordings any number of identical parts can be produced automatically.

What Next? For some time at least, numerical programming will be applied mainly to heavy-duty machine tools. This is because the cost of the "system" is not related to the size and cost of the equipment which it controls. The essential computing and control gear for a simple horizontal boring machine would go quite a long way towards programming a £100,000 skin miller!

At present a complete set of machine control equipment costs in the region of £10,000 to £20,000. Simpler (and less versatile) versions may appear, but there is obviously a limit to what can be done in this direction.

Even where one computing unit prepares tapes for a number of machine tools, the individual playback and control units will cost as much, in many cases, as the basic machines to which they are attached. And

Continued on page 155

MANAGEMENT AT WORK

BETTER COMMUNICATION

A NEW telephone network has been installed by C.V.A. Jigs, Moulds and Tools Ltd. Linking their five factories in the Brighton area, it enables members of the staff in any part of the group to contact each other directly by dialling and to make external calls from the same instruments.

In addition to the main 200-line automatic exchange at the group's administrative centre, there are 100-line satellite automatic exchanges at two neighbouring factories. Unattended, these satellites are linked to the main works by private G.P.O. lines. Seven switchboard operators were employed in the past; now only three are needed to operate the manual positions of the main exchange.

Two smaller factories are connected to the main exchange by external extensions, and provision has been made to include another factory which is being built. Direct access to the public exchange—by dialling "9"—is restricted to certain extensions in the network. To obtain connection to the switchboard from any other part of the system, the caller has only to dial "O."

FULL STORY

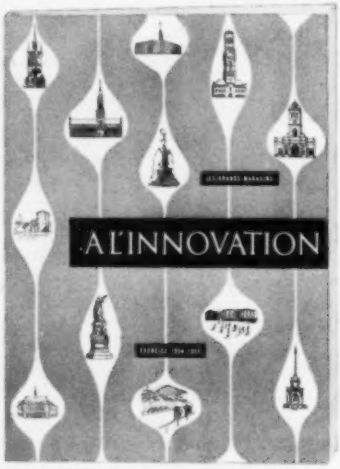
A SPECIAL survey in the September, 1955, issue of BUSINESS disclosed that some British firms appreciate the value of presenting their annual reports in a lively form. There is indeed a tendency to regard the reports not merely as bald statements of the company's affairs but as a means of promoting goodwill among shareholders and members of the public.

So far the main trend—with a few notable exceptions—has been restricted to putting balance sheet details into simpler terms, and including such visual presentations as "share of cake" and "chimney" charts. In addition, there have been overall improvements in typography and layout.

A look at the 74-page annual report issued by Les Grands Magazins à l'Innovation—a large group of departmental stores in Belgium—suggests that most British firms still have a long way to go before they obtain the maximum value from this public relations medium.

The front cover is an attractive and tasteful piece of artwork—more like an expensive sales brochure than an annual report—which immediately takes the document out of the W.P.B. class. Inside are details not only of the group's progress, but of current activities in the whole trade.

Information is also given concerning co-operative stores, and the trend in department store business in other countries, notably the U.S.A. and the U.K. This is followed by a summary of relevant trends in the



". . . British firms still have a long way to go . . ."

Belgium economy (production, prices, wages, and employment) and a discussion of topical issues, including the need for freedom in distribution, an up-to-date picture of hire-purchase trading, and the problems of bargain sales. Only on page 38 does the report begin to discuss the group's own activities in detail—a one-page financial summary having appeared at the beginning.

Twelve pages of illustrations show innovations in the group's administration, selling techniques, staff welfare, and public relation's activities. Another 12-page section is devoted to details of the balance sheets. These are not just recorded in the form of an account, but are amplified by text alongside the figures, explaining how differences or additions gradually build up the net results.

"PAINLESS SELLING"

CREATORS Ltd., Woking, Surrey, have joined the small but steadily increasing band of firms which base their sales techniques on the old axiom "If the mountain won't come to Mahomet . . ." In their case, Mahomet makes his journey to the mountain in a light truck carrying an ingeniously-designed exhibition of the company's plastics.

This consists of 14 three-feet-square display panels, each of which outlines a separate division of the company's activities, plus seven panels showing pictorially how the products are made. Both the photographic panels and those which hold the products themselves fold neatly in the form of a concertina. Thus the sales representative in charge of the exhibition (euphemistically described as the exhibition controller) can erect the entire display without any assistance from the personnel at the factory which he is visiting.

Visitors hear a goodwill message from Creators' managing director, A. C. Anselm, pre-recorded on tape and played back to them. On the same tape machine they are invited to record suggestions, criticisms and technical enquiries of the type which cannot be answered on the spot by the controller.

The plan of action reflects the idea of "painless" selling which inspired Creators to introduce their mobile exhibition. First, the managing director writes to a senior executive at the factory which it is hoped to visit. His letter outlines the purpose of the exhibition—to show what plastics do in modern industry—but avoids sales-talk. It emphasizes that a visit by the mobile exhibition will cause no inconvenience, and that no labour will be required for erection. A section of the firm's canteen is suggested as a suitable site.

The response to this personal letter—on the managing director's own notepaper—is usually favourable. Having secured a number of accep-

tances, the company work out an itinerary.

The exhibition is not replacing completely such conventional selling techniques as direct mail advertising and calls by individual representatives. But the company are convinced that it adds a great deal of punch and persuasion to their existing sales programme.

An ordinary traveller can produce only a few samples from his bag: the exhibition brings the full range to the attention of potential customers. This is done, moreover, without repetitive sales-talk—and in a form which often reaches top executives as well as purchasing officers, works managers, etc.

ROAD TESTS

COMPULSORY "roadworthiness" tests—now being considered by the Government—would have an appreciable effect on business organizations which run large transport fleets. But many of them do, in fact, apply systematic inspection systems on their own account.

The Goodyear Tyre and Rubber Co. (Great Britain) Ltd., for example, have been using a comprehensive system for more than 25 years. Each sales car undergoes a complete inspection every three months. The service garage handling this work has to complete a standardized form which reports vehicles' conditions under 11 main headings — brakes, electrical, cooling, oiling and greasing, tyres and wheels, windscreen, coachwork, engine and clutch, transmission, steering, and road springs.

In this way Goodyear make sure that all their cars are kept in first-class condition. At the same time, their head office at Wolverhampton is able to maintain a full history of each vehicle.

CAR SERVICE IMPROVED

THE fleet of passenger cars based at the Shell Petroleum Co.'s Stanlow (Cheshire) oil refinery is now controlled by V.H.F. radio. The equipment has an effective range of 25 miles, so the whole area of refinery (nearly 2,000 acres) is covered, and cars operating as far out as Liverpool, Birkenhead and the outskirts of Manchester can be called to carry out special or routine duties as necessities arise.

During extensive tests lasting more than six months, the system proved its worth by making considerable savings in mileage and time. As a result of the experience gained in operating the equipment—involving hundreds of calls every day—the overall efficiency of the car fleet has been greatly improved.

EUROPEAN UNIVAC

AS forecast in the "Electronics in the Office" survey which appeared in the November, 1955, issue of BUSINESS, the Remington Rand International Division of the Sperry Rand Corporation have announced that they are about to set up a European computing centre. Located at Frankfurt, Germany, it will be built around the first *Univac* giant general-purpose computer to be installed outside its home country.

The centre will operate on a regular service fee basis, and will be modelled on the company's computing centres in New York and Los Angeles. Its facilities will be available to government agencies and commercial organizations throughout Europe.

Automatic programming will be available in the form of "electronic dictionaries" developed by the manufacturers' research staff. In practice, many computer users duplicate the efforts of previous users. Common, repetitive programmes developed in the past are now stored on metal magnetic tape, and the programming staff can select the sections of the "canned" programmes which are needed for a new application. The computer virtually instructs itself by putting these sections together in the required sequence.

Now being developed is an "electronic dictionary" which will permit the programmer to "talk" to the computer in English, German, French, Italian and other European languages. The machine will automatically translate his words into its own numerical language and put the programme together automatically.

Book Reviews in Brief

THE GOLDEN BOOK OF MANAGEMENT by L. Urwick (Newman Neame) 35s. Published for the International Committee of Scientific Management, this painstaking work collects together, in simple reference note form and with photographs, details of 70 pioneers from 11 countries who have made original and permanent contributions to the study of management. Of particular value, in addition to the biographical notes, are the lists of selected publications by each pioneer. Both articles and books are listed. This is an extremely useful reference book for students of management. There is, surely, a lot to be said for being able to sneak away and look up the details of someone known to every other member of the conversation but the unfortunate self.

FINANCIAL AND ADMINISTRATIVE ACCOUNTING by A. A. Smith and J. G. Ashburne (McGraw-Hill) 52s. 6d. This American text was written for future managers rather than for future accountants.

PROBLEMS IN BUSINESS ADMINISTRATION by T. C. Raymond (McGraw-Hill) 41s. 6d. This is a book of case-studies for analysis by the student of management. It opens with a description of how to analyse a case to get the most value out of it.

INFORMATION PROCESSING EQUIPMENT, edited by M. P. Ross (Chapman & Hall) 70s. A survey of American office equipment.

V.H.F. radio has increased the efficiency of Shell Petroleum Co.'s fleet of passenger cars *(see column one)*

How Work-study can Improve Efficiency from Boardroom to Workshop

By SAMUEL SMITH

Economies made by work-study in the factory are of little use unless the company's executive structure is efficient. This article describes how F. Fryer and Co., London clothing manufacturers, are studying and re-organizing their methods of work, and alsq 'spring-cleaning' their organization from top to bottom.

WHEN a business reaches the stage of development where plans for a new factory can seriously be discussed, there is an obvious opportunity for the management to take a close look at their existing establishment, so that both old and new may be put in order.

One firm which reached this stage early last year were F. Fryer and Co. Ltd., a London company manufacturing overalls and many other types of industrial and military clothing, mainly of cotton. The company has headquarters in Battersea, where all designing and cutting as well as making up is carried out, and there are three other London factories. In all, about 500 people work for the firm.

Fryer's are now engaged in building a new factory on the coast. In London, space is short, and the organization of the shop-floor is dictated, or at least limited by the shape of existing buildings. Only certain walls can be safely knocked down, whereas the new factory can be planned completely to meet their requirements. How much, then, of their traditional way of working should be preserved? Where should changes be made? During the past year the management have been proceeding cautiously, but thoroughly with the introduction of work-study of a kind previously unknown in the firm.

They realized that they must start with the directors' activities and continue throughout the company organization until every operation had been investigated, analysed and wherever possible eliminated or improved. The company is a family business, and it is a tribute to their enlightened outlook that they were prepared to start in this way. One of the directors is responsible for finance and the other for sales. A general manager controls the manufacturing, and coordinates production and sales.

Defining general responsibilities is easy enough. Deciding exactly what work should come under each heading formed the more important part of this initial study. An interesting example of this was the decision that the sales director should be responsible for the selection—though not

Detailed time-study can even double productivity. At Fryer's it was found that one girl could work two buttonholing machines at the same time

the purchasing—of all materials, after consultation with the general manager on the manufacturing possibilities of different types, and on the estimated price of the finished garments. This arrangement provides an ingenious method of bringing the department responsible for sales in at the beginning of the manufacturing process—weaving them, so to speak, into the fabric.

On the manufacturing side, with which this article is chiefly concerned, there is a manager in charge of each production unit, and all are directly responsible to the general manager for the quantity of output. The design department, headed by a managing designer, is responsible to him for quality.

The G.M. also has a "specialist chain" of executives dealing with various overhead functions. These include a personnel and welfare officer, an accountant, a work study officer, a maintenance manager in charge of upkeep of buildings and machines, and an office manager responsible for preparation of tenders and estimates and for the purchasing of auxiliary materials such as stitching thread.

The general manager is clearly at the focal point of a large number of lines of responsibility, an arrangement which gives him the all-seeing position he needs during a period of modernization. His primary concern, now that the management structure is arranged, is the gradual introduction of a thorough study of work on the shop-floor.

The general flow of work in the factory is roughly as follows:

Less Wastage

When the design of a new garment is settled, outlines or patterns of the various parts needed to make it up are drawn on large rectangular cardboard lays. Apart from the design requirements, these patterns are arranged in jigsaw fashion on the cardboard in such a way that as little as possible of the lay becomes wasteland, thus ensuring an economical consumption of raw material. Once the patterns have been marked in satisfactorily, a perforating machine is then passed along the lines drawn on the lay, leaving a trail of small holes outlining the shapes and positions of the patterns.

In the cutting shop the lay is placed on top of some 120 plies of material and a coloured powder is dusted through the holes. The lay is then removed and the top ply of cloth is left with the outlines accurately marked as a guide for the cutting machines.

The greater part of the factory's staff, mainly women, are employed in the making-up shops, stitching the parts together. This work is organized on a divisional system so that each operation is allocated, firstly with regard to the skill and capability of the operative and secondly with regard to the necessary time balance to ensure the production output required. Whilst ordinary plain stitch sewing machines form the bulk of such equipment, special machines are used wherever possible. For example, a side seam on a trouser leg will be run through once on a special type of twin needle machine, instead of running it through twice on an ordinary single needle machine. This type of divisional system is a departure from the old traditional method of clothing assembly, when all such operations for a single garment might be carried out by one worker on one machine.

Clothes are not like motor cars—their identical components do not roll down the production line week after week with only a few modifications made for next year's model. Fryer's factory has to be extremely flexible and able to cope with a large number of orders—small and large—for many different types of clothing. For example, one garment may take only 20 minutes to make whilst another may take three hours.

There are naturally certain stock garments, based on standard styles, where it is possible to adjust the size of an order so that it will form the most economical quantity for mass production, but there are in addition very many special orders and contracts for a variety of styles where expert judgment and planned control is required to work these in with the standard garments and still achieve maximum productivity.

Organization of the work depends largely on establishing the right time balance between orders. For example, when 4,000 garments are to be made in a week, it may be necessary to arrange two teams of operatives, each turning out one complete garment every 72 seconds. For the purpose of organizing such work, and for fixing rates of pay, work study in the past has been restricted to work-measurement, based on existing

The cutting shop at Fryer's. Work study showed how certain trimming operations on the made-up garment could be eliminated by greater accuracy in the original cutting

Work study at the Fryers factory showed that the sewing machines had actually been stitching for only about 25 per cent of the working time. Hence by re-organizing the work, it was not difficult to increase output —in some cases to double or treble it

methods and standards. Usually experienced operatives were time-studied on each operation, and from this a standard time was set for each task. This gave a basis for the factory's piece-work system which worked well enough both in maintaining production and in producing some of the highest earnings for overall manufacturing employees in the country.

Process Flow Charts

However, as the system was essentially based on work as it was done, it offered no scope for the improvement of methods. When work study proper began this year, the first studies were commenced in one of the branch factories where two styles of clothing were being made.

First, the history of what happened to a garment as each operative dealt with it was recorded on process flow charts. Every operation and movement between operations were listed, and each job recorded in such minute elements as "picking up material" or "placing material to needle," together with the time taken. Then there were the details of how the job was done—whether with one hand or two, whether a seam was started at the top of a leg or at the bottom. Then the girl's comments about the best way of working, her complaints about difficulties and ideas for improvement and any other relevant observations.

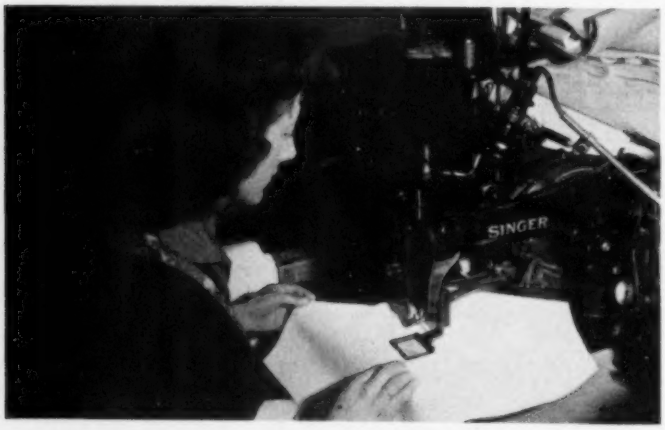
A number of operatives were studied on each operation. The only question asked at this recording stage was "What do you actually do?" An eye for detail in the "recording angel" class was the examiner's primary need—together with the personality and tact to record and extract information from operatives ranging from 15-year-old girls to 60-year-old ladies.

The next stage was that of analysing the mass of detailed information, and here the question asked all the time was "Why?" Why *was* everything done that was done? Why was it done *when* it was? Why was it done by *this* particular girl? Why *should* it be done at all? Did it really matter whether it was done *in this way or in that*?

First, a general finding: sewing machines were actually stitching for only about 25 per cent of each working hour. What could be done to improve this?

Better Handling

By and large, the conclusions reached in the first analysis pointed to better opportunity for improvements in the flow of work and handling of materials rather than in the methods of operating the machines. One girl might get better results by starting the seam at the bottom, another by starting at the top. Only where the great bulk of evidence agreed that one way was superior, was a definite new method laid down.



Common sense, yes—but it took work study to discover that tags could be sewn more quickly on to the appropriate part of a garment before it was made up, rather than afterwards

It was found, however, that certain hand-trimming operations on the made-up garments could be eliminated by ensuring accurate cutting in the first place.

Perhaps most important of all, it was found that the method of organizing the jobs was preventing some girls from making the best use of the skills which they possessed. For example, girls who were capable of a good rate of highly skilled work such as stitching on collars, were having to waste much of their time on simpler pieces of stitching which a learner operative could do as well.

Skill-groupings

These findings allowed the management to arrange skill-groupings and speed-up the whole production process.

Even where neither the methods nor the stitching machines themselves were open to improvement, it was discovered that a good deal of time was being lost, and bad work going through, because the girls were not sufficiently skilled to adjust the machines—to obtain, for example, a looser stitch for special or treated materials.

The evidence also suggested that higher containers for the work, at each side of the machines, would cut out waste of time and effort in reaching and putting the cloth to the needle. A better system of transporting work from one operator to the next was also indicated.

Further, in spite of the standardized design of machines, certain evidence in the records inspired the management both to improvize new gadgets themselves, and to get higher production out of old ones, particularly from a study of what right and left hands were doing at any one time. For instance, an unnecessarily long time was being spent on the simple job of spearing holes in a denim blouse belt. The operative had to hold the blouse in position with one hand, while she pierced the holes with the other hand. To avoid this, a machine was constructed consisting of two bars of wood, each armed with the right number of spikes, and brought down onto three belts simultaneously by the operation of a treadle. It sounds, and is simple, but it has trebled productivity in one small department.

More ingenious still was an in-

provization which resulted from study of work on button-holing machines. They are semi-automatic machines, and the operative's task is to place the material under the needle, depress a lever which in turn moves a jig conveying the material round the needle in the shape of a button-hole, and on completion of the stitching a knife drops to pierce the hole and a trimmer cuts off the thread ends. The question was asked—Why should not the operative carry out other work whilst the automatic process of the machine was carrying out its task of forming the button-hole? The solution was to place one machine on the left-hand and one on the right-hand side of the operative, so that she fed and started the left hand machine and then was able to feed and start the right hand machine, returning to the left-hand machine to complete her cycle. This arrangement was tried out, worked successfully and is now a regular arrangement in the workshop—with productivity doubled.

The question "why" also produced remarkable results in the work of putting on labels—the kind of job which is easily forgotten about, or not thought a likely place for improvements until a complete survey of this kind is made. Why, it was asked, were labels being put on after the whole garment was made up? The girl had to fumble among the folds, arms, legs and body to find the right place, then keep the irrelevant parts of the material out of the way. Why not put the label on its predestined position while the material was still a detached piece?

STUDY SHEET

TOTALS

A time-study sheet for a single operative. The operation is broken down into its basic elements and the time taken for each is recorded. When the time-study officer assesses the average girl's speed, a basic time for the operation is fixed

Pre-creased Labels

Further, it was discovered that a high proportion of the time spent in labelling was taken up in the awkward job of folding in the ends and sides of the cloth labels before the needle got to work on sewing them on. Could not labels be bought with the ends ready-creased? The suppliers were asked, and it turned out that pre-creased labels could easily be made.

Lastly, in the cutting shop, there was an interesting example of how the study showed that certain mechanical methods were not necessarily time-saving. The plies are laid out, 120 deep, from a holder fitted with a roll of cloth; this is rolled along above the cutting table until a fold is made in the cloth at the end of the required length, then rolled back. The work is done by one man, simply rolling the holder back and forth. There are electric automatic machines for doing the same job, but the cutters would have to stand around and wait while the electricity did its robot work; and the study showed that one man did the rolling quicker than the automatic machine.

Applying the Results

After the analysis, the application of the results. Apart from special jobs, such as labelling, the new ideas were introduced with a new team of specially selected and trained operatives. Formerly, all girls were given a "common sense" unplanned training, starting by making the easiest parts, then moving on to the more difficult. There was no clear connection between training and the particular work they were going to do, no definite system or method for doing it.

The selected team were given a three months' training course based on the new methods, then set to work alongside two existing teams doing the same work the old way. A separate booking system was installed for recording the work of the new team, and comparing it with that of the old. It was found that the new way gave a 20 per cent increase in production.

This parallel application made it possible for girls in the two original teams to see for themselves what the new methods were like. If a sudden switch had been made, turning everyone over from old to new, there could have been no such opportunity for comparison.

It is hoped that before long 80 per cent of all workers, including the staff of the new factory, will have been trained in the new methods.

Under the guidance of a skilled craftsman, an apprentice learns to use a lathe. Later, he will visit other firms in the group scheme to gain experience in related trades outside the scope of his own company

BUSINESS presents here an account of a group apprenticeship scheme, introduced in the British engineering industry, which has been devised specifically to overcome the difficulties normally encountered by small firms. If other industries were to adopt similar schemes—of equal thoroughness — Britain might well achieve a nation-wide apprenticeship system as efficient as that operating in Western Germany, which was reviewed in last month's issue.

These Small Firms Co-operate to Train Apprentices

By PAUL BENNETT

AT a time when increasing foreign competition is providing the British engineering industry with the greatest challenge in its history, and the advent of automation is further emphasizing the opportunities for expansion, the progress of many firms is being endangered by a shortage of skilled craftsmen.

There is no scarcity of boys of the right type who want to become engineers. The real reason why the demand for skilled craftsmen and technicians is outstripping the supply is the lack of adequate training facilities.

Many large firms, it is true, run excellent training schemes which give youngsters a thorough knowledge of their chosen trade. But the small firms—and by far the larger proportion of the industry is composed of companies with fewer than 100 employees — cannot generally provide comprehensive training for their apprentices.

They are not so well-equipped, and they cannot always afford the time required of their staff to organize effective apprentice training. The result has been that the small and specialist firms, who constitute the vast majority, experience great difficulty in obtaining the apprentices they require to become tomorrow's artisans, foremen and managers.

It was to overcome these difficulties of small firms that the Engineering Industries Association Group Apprenticeship scheme (E.I.A.G.A.) was developed. Successfully tried out by a London group of engineering firms, the scheme has now been launched on a national scale, and participation is open to any firm in the industry.

Operated by the Engineering Industries Association in conjunction with a firm of consultants, Industrial Administration (R. & A.) Ltd., the scheme is based on the pooling of whatever training facilities are possessed by individual firms situated in a particular area. One company, for instance, may be able to give excellent training in the use of tool-room machinery, but would not have the means of teaching foundry work. The reverse might be the case of a neighbouring firm, while other local companies may be engaged on engineering work of widely differing forms and have facilities for training only in their own particular speciality.

Although individually the facilities of these firms may be very limited, collectively they have the means of giving apprentices training in a diver-

Interchange visits between companies give apprentices the opportunity of gaining experience not available in their own firm

—*see page* 105

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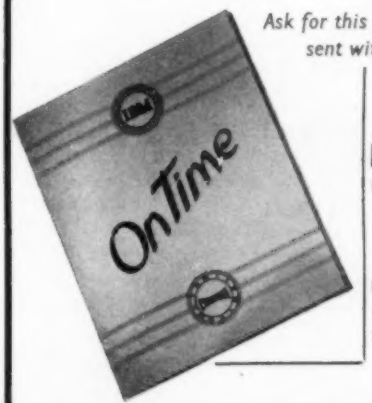

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ity of engineering subjects. By arranging between member companies for the interchange of apprentices, the scheme gives trainees the opportunity of gaining experience not available in their own firms, and thus provides a more comprehensive and well-balanced training than would otherwise be possible.

The scheme was first put into operation by the West London E.I.A. branch last March, when 12 firms within a radius of about 10 miles of each other agreed to participate. Further group schemes have now been started in other areas, and the E.I.A. hope that the scheme will eventually be extended to cover Britain.

The control of each group is the joint responsibility of the member firms, who set up a management committee comprised of senior members of each company, together with co-opted representatives of youth employment services and educational organizations. The routine administration, however, is carried out by a supervisory engineer on the staff of the consultants.

Four Grades

For convenience of administration, groups are normally composed of between 12 and 20 firms, providing for the training of from 60 to 80 apprentices. But the size depends upon local conditions—the number of engineering trades covered, and the travelling facilities available for the interchange of apprentices between factories.

E.I.A.G.A. provides training for four types of apprenticeship—craft, student engineer, commercial, and graduate. On learning of the requirements of a firm, the supervisory engineer is responsible for supplying candidates in the grades desired. His task here is made much easier by the co-operation of the youth employment services and educational organizations who are represented on the management committee. Indeed, this alone is often enough to induce firms to join the scheme, for many companies are finding it almost impossible to recruit apprentices of the right type on their own account.

Group supervisors pay periodic visits to firms to check that apprentices are following their training schedules and deriving maximum benefit

Candidates are interviewed in the first instance by the supervisor, who makes an initial assessment of character, physique, educational standard, and general suitability. Great care is taken in selection, for although a large firm may be able to absorb a youngster who fails to reach the required standard during training, the smaller company is in no position to do this, and time and money spent on training may be completely lost.

The supervisor also interviews the parents of all boys to ensure that they understand the conditions of training and the opportunities available. Only when being completely satisfied up to this point does the supervisor submit selected candidates to the sponsoring firm for interview and acceptance.

Progress Record

As soon as a candidate is accepted, the initial entry is made upon his history sheet, which will record his progress throughout the apprenticeship.

The history sheet, which is retained in the group files, enables the supervisor to gain an immediate picture of any one of the apprentices under his charge. It contains the apprentice's name, address, birth date, date of acceptance into the scheme, the name and address of his parent or guardian, father's occupation, school, headmaster's name, the form reached at school, leaving date, certificates gained, sports and hobbies, experience (if any) prior to entering the scheme, the trade he wants to take up, the name of the sponsor firm, date commenced, proposed indenture date, indenture classification, indenture date, and the date on which the apprenticeship eventually ends.

Indentures are normally for a period of five years, and are signed by the apprentice on reaching his 16th birthday or as soon afterwards as possible. This does not apply, of course, to graduate apprentices, who usually do not commence their apprenticeship until after they are 21.

The sponsoring firm contract to maintain the apprentice in continuous employment over the specified period. At the same time, the apprentice is bound by his indentures to abide by the rules of his sponsoring company — and of any firm with whom he may work during the course of his training.

The greatest demand is, of course, for the craft apprenticeships. Among the crafts covered in this grade are:

Machine shop—turner, miller, grinder, fitter

★ **The group supervisor is responsible for supplying firms with all the apprentices they require**

—*see this page*

★ **An individual training programme, in which details of practical and theoretical work are clearly laid down, is prepared for each apprentice**

—see this page

Foundry—pattern-maker, moulder, foundryman

Metal-working—welder, sheet metal worker, boiler maker

Specialized trades — tool maker, millwright, electrician, instrument maker, wireman.

An important aspect of the training in this grade is that it is designed to provide not only a high degree of skill in a particular trade, but also some experience in complementary crafts.

The course for a turner, for instance, normally includes two years' preliminary work, in which the apprentice spends 10 months on bench duty, a brief period on inspection, and 12 months in the use of machines.

The remaining three years are devoted to advanced practical training on centre lathes, turret lathes and boring mills, with supplementary experience on other classes of machines.

Arrangements are also made for craft apprentices to spend brief periods in other departments—either in their own firm or with others in the group—which may include a foundry, welding shop, and a drawing office. This is in order to give them some knowledge of the work of related trades.

The training syllabus for crafts has been approved by the National Joint Body of the Engineering and Allied Employers' National Federation, and the Confederation of Shipbuilding and Engineering Unions.

Student engineer apprenticeships are given to candidates with a higher educational standard (G.C.E. in appropriate subjects). These apprentices receive a wider and more general training in order to provide a background suitable for those who will later occupy technical posts in production, planning, work study, inspection, and test departments.

The syllabus here is designed to cover the requirements of the appropriate professional engineering institution. After a year of basic engineering training, which includes general bench work and machine shop practice, the apprentice spends between four and six months in each of various production departments. During his final 12 or 18 months, a period is spent in a drawing office, planning department, and a works control office.

Apprentices intending to make a career on the sales staff of an engineering firm can train for the last few months on estimating and tendering.

The course for commercial apprentices provides training for candidates of G.C.E. standard who wish to take posts in costing, accounting, purchasing, and secretarial work. A period of practical experience in the works is followed by basic clerical training. Subsequently, the apprentice spends a period in each functional office to gain experience in day-to-day duties and routine.

These apprentices are expected to study and obtain qualifications in commerce, accountancy, or secretarial practice. A short course of training with Industrial Administration (R. & A.) Ltd., covering more advanced subjects, is also offered to a limited number of selected apprentices in this grade.

★ **A group certificate of apprenticeship is awarded at the completion of their training to all satisfactory apprentices**

—see page 152

The graduate apprenticeship provides a two-year practical course of training for university graduates. This is arranged in accordance with the requirements of the particular professional institution concerned. Experience in all aspects of manufacture in the apprentice's parent company is supplemented, where necessary, by further practical experience in the factories of other group members.

In all grades, an individual training programme is prepared for each apprentice. Details of both practical and theoretical training are clearly laid down. The supervising engineer maintains close contact with the apprentice, his sponsoring firm, and the department immediately concerned with the apprentice at any particular time. He checks that the training is, in fact, following the schedule and that the boy is receiving the maximum benefit from it. Training programmes may be revised from time to time where events show this to be desirable.

As the apprentice follows the course of training laid down for him, he moves between firms within the group, gaining experience appropriate to his grade under varying conditions and on a wide range of products.

These moves only take place in order to provide training on a particular process or class of work, and do not normally commence until the apprentice has settled in and become established with his parent company. They are usually for spells of two to four months, with intervals during which he returns to the sponsoring firm. The apprentice normally completes his final year with his own firm without a break.

Theoretical background to the apprenticeship is provided by attendance at approved courses of technical study. The supervising engineer advises each apprentice on the courses for which he should enrol. Part-time day release with pay is arranged for each apprentice so long as he maintains satisfactory progress.

In addition to the normal courses in technical subjects, lectures on elementary management, administration, and social subjects are given by the consultants' staff. These are designed to give an apprentice some appreciation of the structure of the industry, its problems, and their effect on human relations.

A close check is kept upon apprentices' progress in theoretical studies by obtaining reports from the technical colleges they attend. Apprentices are expected to take examinations on completing their courses. Craft apprentices will normally take the City and Guilds certificate examination for their trade, while student engineer apprentices are encouraged to qualify for a Higher National Certificate and graduate membership of one of the professional institutions.

The supervising engineer prepares reports on each apprentice and these are sent at regular intervals to the sponsoring companies. These reports cover conduct, time-keeping, ability in theoretical studies and practical work, together with an opinion on progress made and poten-

Continued on page 15

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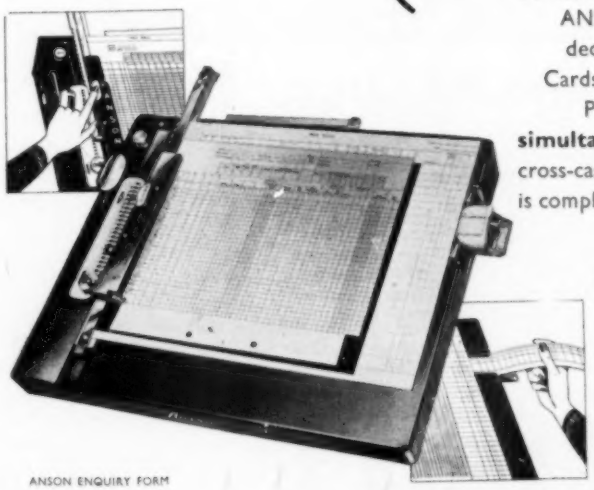

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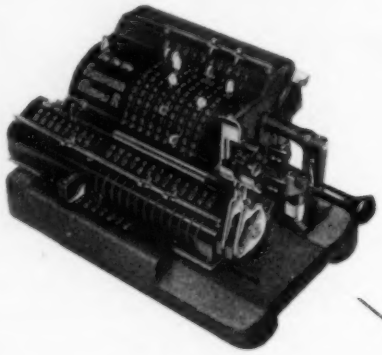

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THE END IN SIGHT—for clerical work connected with retail sales, job-costing and stores control, when the new punched tape register comes into producion

The small businessman who feels that he could never afford the capital cost of automation in the office, should examine the prospects offered by the revolutionary but inexpensive invention described here. A new 'automatic' cash register provides a punched tape record of every sale, thus abolishing the clerical work of sales analysis. Similar machines are expected to abolish the clerical work of job-costing and store-keeping.

A Low-Priced Revolution in Office Work

By G. R. LAMPTON

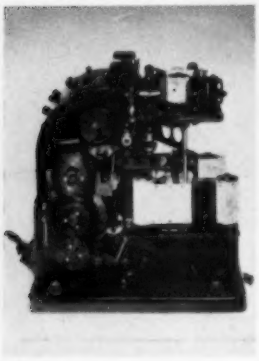
EXPERTS on modern machines for "processing" office paperwork agree that the real bottleneck is "input." It is all very well to have a complicated problem solved by an electronic computer in a few seconds, but someone has to feed all the appropriate information into the machine. This may involve a lot of tedious work extracting information from a variety of sources and punching it into cards or tape.

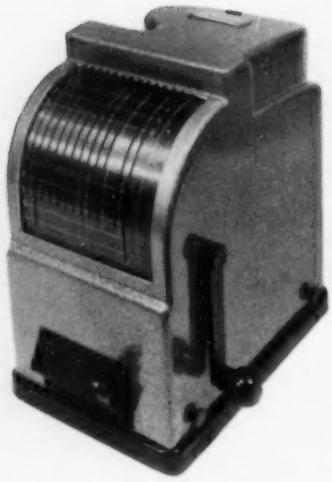
Last June, BUSINESS published an article on "Automation in the Office" (page 99) describing the development of the automatic typewriter in the United States. This machine can automatically punch into tape every letter or figure that is typed. The tape is a record of whatever has been typed, and it may be fed into another machine which will convert the code on the tape into the appropriate holes on a punched card, which can then be used for other "processing." For example, the typing of an acknowledgment of an order provides the basic information for the order to be executed in each of the appropriate departments of a firm, even to the typing of the label for the packaged order. The automatic typewriter cuts out the laborious hand-punching of cards and copying of documents, once they have been originally typed.

BUSINESS can now describe in detail a new development which has occurred in Britain—not in the United States—and which will in time solve the "input" bottleneck for many types of sales and accounting information that is not typed in letter form —for example, cash sales in a shop, job-costing in a workshop and stores accounting in a factory.

The recent news of an agreement between the Co-operative Wholesale Society Ltd. and Industrial Accountancy Partnership Ltd., for the manufacture and financing of a new type of cash register, is the culmination of several years of development work

When the levers are set to the appropriate numbers—e.g. co-op customer's number and value of purchase—and the handle is turned, the register prints a ticket for the customer and at the same time punches the information in tape





on a machine which produces punched tape whenever any item is "rung up" on the register, and this punched tape can be used for punching the holes in orthodox punched cards which are then available for sorting and tabulation, to abstract any relevant information.

The reason why the C.W.S. are interested in this new invention is that they have a serious clerical problem in analysing co-operative sales throughout the country, so that customers may receive their "dividends." At present, when a sales assistant in a Co-operative shop "rings up" a sale on the cash register, she also registers the customer's membership number on the machine, and this is printed, toether with the value of the sale, on the ticket which is torn off and given to the customer. But then the roll of tape in the register has to be sent to Head Office, and each item punched on to cards, so that the total sales to a particular customer may be assessed, and the appropriate divident declared. The New Swindon Industrial Co-operative Society, for example, normally use 20,000 punched cards a week—punching by hand, and totalling the sales to each customer and analysing sales under various headings.

The invention which will be described here is rather similar to a cash register, and if used in a co-operative society—as it was recently used on a trial run by New Swindon — the same basic information would be "rung up"—the number of the customer, the type of goods sold and the value of sales. Also the sales assistant would insert her key in the machine, so that sales could be analysed according to assistant. But this new invention, instead of merely *printing* the information that is "rung up," also *punches it* on to tape. And the tape code system is the same as is used on punched cards.

Punched into Frames

The tape feeds through the automatic register in blocks. It stops at regular intervals, so that everything that has been "rung up" on the register, relating to one particular transaction, can be punched into one section of tape, called a "frame"—like the section of film which makes up one picture on a movie film.

On one "frame" or section of the tape, there are 16 columns of holes, just like the first 16 columns on a punched card. This is enough to punch all the sales information required, but for other work such as for job-costing, it is possible to use a "frame" of 32 holes.

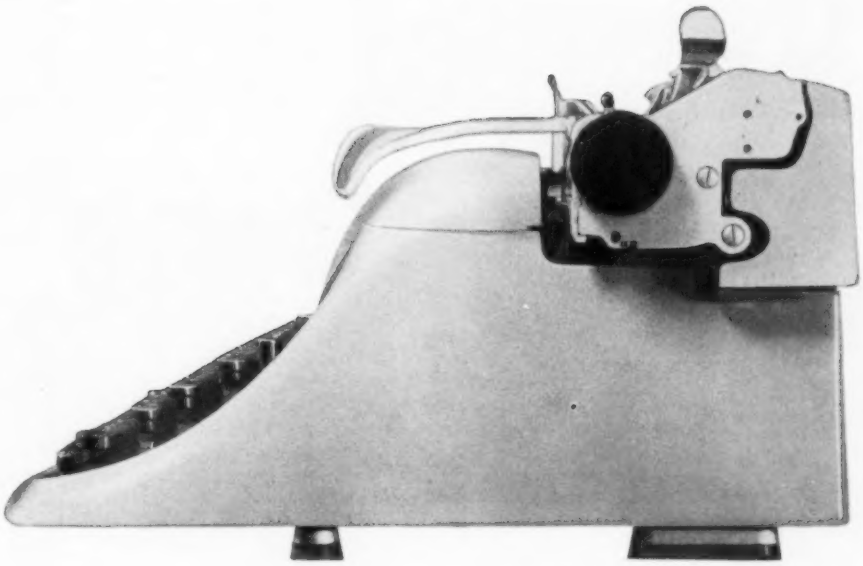
The new machine is now going into mass production, and of course the first call on output will be for the Co-operative Societies. After their requirements have been filled, in a year or two from now, other retail shops, etc. will be able to buy.

The only similar equipment in the United States, is in a Wall Street bank, which has ordinary cash registers connected by electric cable to a punching machine, and so controlled by electronic equipment that whenever a bank clerk "rings up" a transaction on a register, the appropriate information concerning this transaction is punched on to a card in another part of the building. But this is an expensive type of equipment.

An essential feature of the new British invention is that when it gets into mass production it will be relatively cheap—probably around £70 to £100. It is not electronic, and not even electrical, but merely mechanical. If one such machine is provided in each department of a store, at the end of the day not only will the customers have each received their printed sales slip, but it will be possible to take from each machine a roll of tape which can be fed straight into a "reader" that will convert each "frame" of the tape into a punched card. This may then be fed through a sorting machine and a tabulator. Gone will be the laborious job of punching information by hand into cards, and gone will be the dreadful

The Basic Idea

Behind most revolutionary inventions is a simple idea. And the basic idea behind the new automatic register came from the motion picture industry. The film in a cinema projector moves one block, or "frame" at a time, stopping while the shutter opens and the photograph is projected. Likewise in the automatic register, the tape moves one frame at a time, stopping to have all the holes concerned with one transaction punched at the same time.



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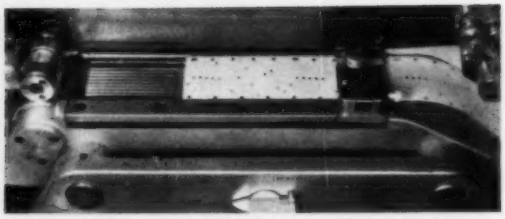
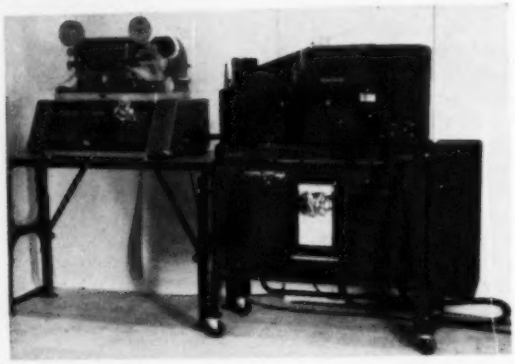


The punched tape is run through a "reader" directly connected to an orthodox punching machine which transfers the data to orthdox punched cards. These are then available for sorting and tabulation, to produce any desired analysis or summary of the original information

job of trying to recruit sufficient girls and train them to a high degree of skill and speed, only to find them leaving when they discover how monotonous the work is. Gone also will be the risk of error in transcribing information from sales tickets to punched cards.

Another possible field for the new automatic register is in hire purchase. At present a large amount of clerical work arises in hire purchase business because customers tend to pay their instalments at irregular times, in amounts of money different from the original agreed payment, and often at a different office from that originally specified. But with the new automatic register, it will be possible to fold into a hire purchase payments book a pre-punched card giving the name and address, contract number and other details regarding the payee and his contract. When this card is presented with a payment at any office, the card can be pushed into a slot in the register, and the information on it picked up automatically on the machine. There can be no transcribing error, and as a result the "frame" of punched tape sent to Head Office will be accurate, and easily "married up" by ordinary punched-card equipment with the required payments on the original hire purchase contract.

One of the most revolutionary uses of this new automatic register will undoubtedly be in the field of job-costing. At present, when a workman is given a job, all the appropriate information has to be entered up on his time sheet, and later transcribed on to punched cards for analysis and assessing the cost of the job. But the new automatic register makes it possible for the workman to take his time sheet to the clerk who is giving out the job cards. The time sheet will be fed into a slot in the top of the machine, and on it will be "rung up" the appropriate information—the time (by the control clock), the workman's clock number (by inserting his key), the number of parts to be made, the job number, the number of the operation, drawing number, part number, or other appropriate technical information.

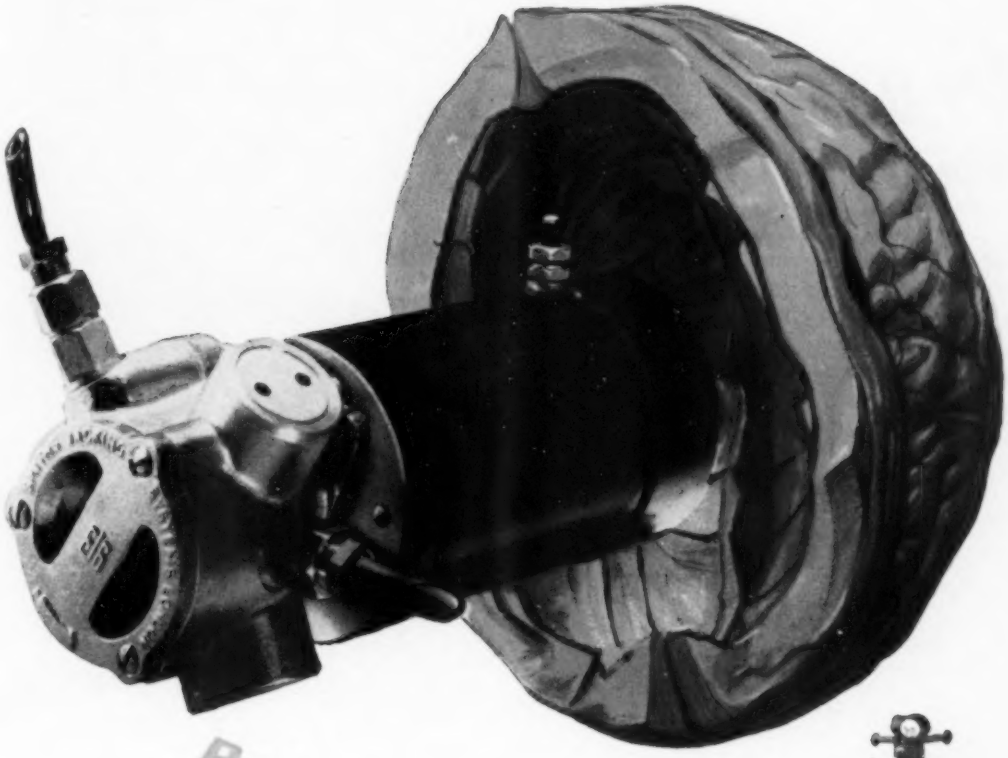


The automatic register will print this information on the workman's time sheet, and also, of course, punch it on to a "frame" of tape. Later, when the workman has finished the job, his card will again be inserted in the machine, and the job number and the time of completion will be "rung up." Thus all the appropriate information will be on the reel of tape, which may then be taken away and analysed. If there is no further job to be given to the workman, the appropriate code number for "waiting time" will be "rung up," instead of another job, and this "waiting time" will therefore come into the analysis, for bonus purposes.

Stores Control

Yet another possibility with this new automatic register lies in stores control. At present, it is the usual procedure, when a workman goes to the stores, for the store-keeper to collect the components or tools required from a bin, and take the bin card back with him to his counter so that he may enter up the appropriate information from the workman's job card. But with the new automatic register it will be possible to have a pre-punched part-number card with each bin card. And when the bin card is inserted in the register, so that details of the goods going out may be "rung up," the pre-punched part-number card will also be inserted, so that the part-number may be punched automatically when the number of parts taken, job numbers, etc. are "rung up." This will avoid possible error in transcribing complicated part-numbers, and in addition to the bin-card being entered up correctly, a "frame" of tape in the register will receive all the appropriate information, which may then be analysed, and a record of stores transactions made without need for monotonous clerical work.

Many heads of smaller firms have felt for some time that the revolution which will undoubtedly come about through the introduction of more electronic equipment into office work, will affect only the larger firms, and be of little help to the smaller. In some cases, this may be true, but one thing certain about the new automatic register, is that it will be of help to the small firm as well as to the large. Even those who cannot afford the complete punched-card equipment and a "reader" may be able to have their information "processed" by an outside professional organization, just buying for themselves the automatic registers.



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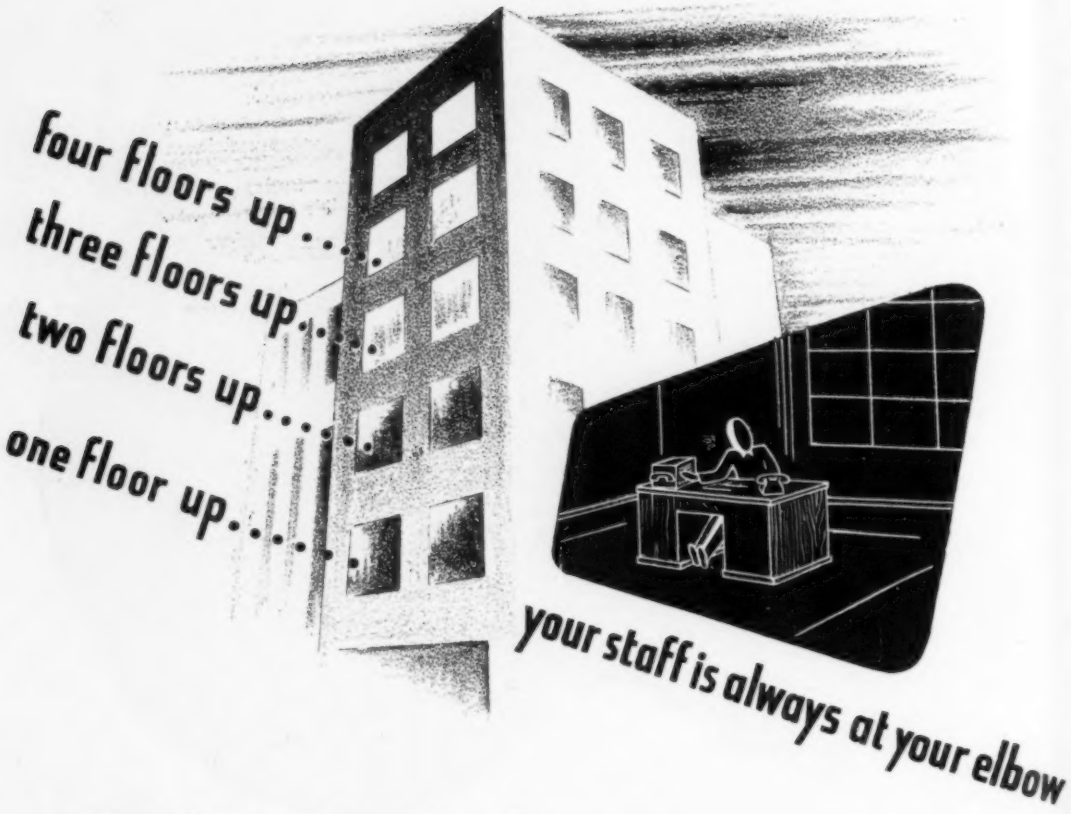

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The pricing details are inserted by hand, then extended and totalled by calculating machines

With a rapidly growing flow of orders to be dealt with daily, the order procedure at The Metal Agencies Co. Ltd. was in danger of being "left at the post." Several "home-made" methods were tried, without too much success, until it was decided to call in a firm of systems consultants. The result is an extremely efficient system which involves the use of spirit duplicators, and ensures that orders can be taken out of stores, invoiced and made ready for despatch on the same day as they are received.

Spirit Duplicators to the Rescue

They 'Mastered' Their Order Problems

By J. C. WARD, A.A.C.C.A.

Office Manager, The Metal Agencies Co. Ltd.

CARRYING a range of some 25,000 articles, and handling up to 1,500 orders per day, the Metal Agencies Co. Ltd. are one of the largest builders' and engineers' merchants in the country. Operating from Bristol, the company's activities cover an area right down to the tip of Cornwall, as far east as the environs of London and as far north as Mid-Wales.

In recent years the company's activities have expanded very rapidly, and one of the problems with which we were faced was the vast amount of paper work required to deal quickly with the growing order flow. These orders are in three forms—those which come in by post from the customers and travellers, those taken over the telephone by a specially trained staff of order clerks, and those received from regular customers who call and collect the goods, but have them charged to their accounts.

In the ordinary way, the first two categories were typed on an order form, which acted as a warehouse instruction sheet and on which it was necessary for warehouse men to add various consigning details, for example whether goods were contained in a carton or a bag, approximate weights, and so on. After going through the process of what is known in the trade as "looking out," and having had the consigning details marked on the order form, it was sent to the shipping office. In this department the orders were sorted into one of 54 carefully worked out lorry delivery runs, and delivery notes were prepared. Here was where the main difficulty arose.

Inevitably, the bulk of orders tended to flow into the shipping office towards the late afternoon, by which time all goods had been looked out and moved either by mechanical trucks or conveyers to the loading bays where the lorries were ready for loading. These lorries could not be loaded until delivery notes had been prepared from the original order, as obviously it was necessary for the drivers to know exactly what loads they had for a particular journey, so that their lorries could be loaded in order of geographical dropping. The result was that in spite of several typists regularly working late, some orders were left without delivery notes and loading notes. This meant that lorry drivers and lorries were kept waiting the following morning until these notes were prepared and the final loading could be completed.

Together with the works manager, my attention was directed to finding some means of overcoming this problem. In the event, the works manager designed a set of forms which incorporated delivery and loading notes with the initial order preparation. But there were two major problems to overcome in connection with this.

Firstly, it was impossible to guarantee 100 per cent stock availability. As the main theme of this company's activities is speedy service, any attempt to pass the orders over the stock control system, prior to processing, would need more time than was possible if we were to maintain the proper balance and economy of the predetermined delivery pro-

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The master progressively builds up its information to become a complete history of the transaction. Two of the company's six machines are seen here

gramme. Our vehicles serve an area of 25 miles from the main depot twice daily, up to 50 miles once daily and beyond that several times a week. It is obvious therefore, that speed in processing orders must be maintained. Consequently, any goods which are out of stock have to be so marked on the customer's advice note. Although the newly-designed forms could take care of this point, they had to be prepared with suitable carbon paper so that the warehouse men's comments could be clearly read on all documents.

The second problem was connected with our practice of substitution. In many cases, where customers order goods, we know of alternatives which are equally acceptable by the customer, should we not have the original available. Rather than delay delivery and create undue correspondence, our practice is to substitute what we know in most cases to be acceptable. Again, these comments have to be included on the delivery and loading notes if the customer is to be kept in the picture.

The new printed pack of documents, with carbon papers, was eventually considered as a sound workable proposition and supplies of these were obtained. They were immediately successful and enabled us to overcome the main problem of clearing all shipping office paper work daily. To a very large extent they also catered for our "out of stock," and "substitution" practices which had previously caused difficulties.

We soon realized, however, that the next logical step was to prepare the invoice at the same time as we prepared the original order. The invoice was, after all, a facsimile copy of the original order and the existing method involved having this prepared by an entirely separate set of typists who merely copied what was on the order.

At the time, we were employing approximately eight typists preparing orders, four typists preparing delivery notes, (which were even then in a very

- **The system used by Metal Agencies enables orders that come in quite late in the afternoon to be despatched first thing next morning**

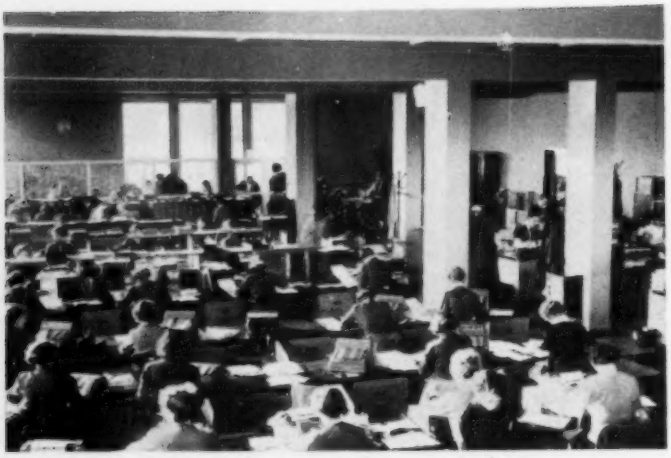
unsatisfactory abbreviated form) and some 22 typists preparing invoices. Immediately we commenced to use the printed packs we were able to economize to the extent of the four typists who would have been preparing delivery notes. Their work, of course, was now automatically part of the initial preparation.

Our original idea was to include additional invoice copies in the pack, insert serial numbers on the orders, and route the partly completed invoice form to the invoice department. This allowed the remainder of the order and delivery forms to go the same circuit as before. The order would then, after completion of shipping, be forwarded to the invoice department whose function (as before) would be to price and extend the order and complete the invoice. By this method, however, the typing of the invoice would consist only of inserting the prices and extensions—the remainder of the work having already been completed at the order preparation stage.

We immediately ran into numerous snags, however, because we were now required to produce a set of 12 documents in one operation. This necessitated the inclusion of high quality, expensive carbon paper, which could be used only once. Since an essential part of our system is for the original order to travel around the warehouse (the speed of our order processing will not permit any other arrangement), it was necessary also for this carbon paper to be of a quality which would not only provide good typed copies, but give equally good reproduction of handwriting for consigning details, substitutions etc. This was found to be an almost impossible demand, as the last copies of the set were of an unsatisfactory quality, while the cost of carbon sets was proving to be more than the labour saving which its use would produce.

We were therefore arriving at a stage where, even if we could overcome the technical difficulties, we had prepared a more efficient system, but at a *higher cost* than our original methods. The company's works manager then mentioned a system using a spirit duplicator he had seen in operation in a company carrying on similar activities to our own, and as far as he could judge, operating very satisfactorily.

The advantage of installing spirit duplicators lies in their ability to produce many clear copies from a "master." A master is produced on a sheet of paper backed by a hectographic "transfer sheet." This is similar in appearance to ordinary carbon paper, but is used with the carbonized side *facing* the back of the paper. Thus a back-to-front version of the written or typewritten matter is produced on the rear side of the paper, and it is from this "master" that the copies are made. It is clipped



In the invoicing department, the clerks complete the partly typed invoices by inserting prices, then run them off on the spirit duplicators

into the spirit duplicator and copy sheets are fed in. These are "damped" with spirit, pressed against the back of the master, resulting in dry copies.

The works manager and I visited the consultants handling the system, and obtained all the information we could. There followed a series of lengthy discussions with the consultants.

On the face of it, the method appeared to overcome most of our difficulties, but we seemed to be reaching a stage where innumerable discussions of a theoretical nature were proceeding without producing any tangible result. It was therefore suggested to the consultants that the best way of proving whether their system would meet our needs was to carry out a trial run.

My proposal to them was that if they were prepared to place at our disposal one of their machines for a period of one week, we would undertake to put through some 50 orders a day on this system, giving practical demonstration not only of its capabilities, but also producing some of the practical snags which we realized were bound to result from such a fundamental change of system. The warehouse and shipping managers were called in and they both gave enthusiastic support and agreed to give the system a trial run.

We commenced our first run one Monday morning and the result was an almost unqualified success from the very start. On the second day we decided to increase the number of orders to 100 and on the third, we decided to increase even further to 200. By the end of the week 200 orders a day were being handled quite comfortably.

We then turned our attention to the invoice procedure, which so far,

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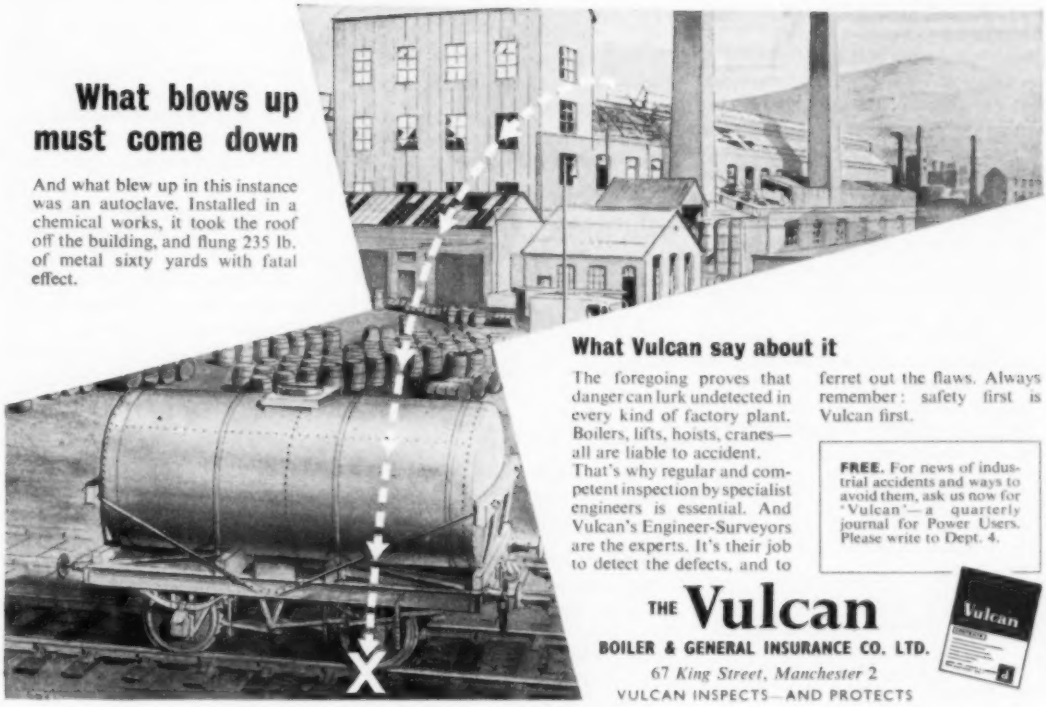
What blows up must come down

And what blew up in this instance was an autoclave. Installed in a chemical works, it took the roof off the building, and flung 235 lb. of metal sixty yards with fatal effect.



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we had not included in our arrangements. Originally it was our intention that the invoice copies should be routed to the invoice department partly completed, and the pricing and extensions done as a second operation. The immediate problem arose, again in view of our essential streamlined and speedy processing, that the time taken passing the orders through the machine would delay the passing of the original orders to the warehouse. At this stage we were almost at the point of wondering whether, in fact, the invoice procedure *could* be embraced, when someone had a brainwave—simply to pass the *master* of the order through to the warehouse. We decided to try it out. Briefly the routine was to be:

1—Stamp the master order form with the addressing plate.

2—Type in all order details.

3—Pass out to warehouse for "looking out," comments re stock availability and consigning details (to be inserted by the warehouse man in handwriting, using the special carbon).

4—Run off shipping documents on the spirit duplicator, i.e. delivery notes and loading notes.

5—Insert on master order date of despatch and pass on to invoice department.

6—Insert pricing details and extend and add by calculating machines.

7—Run off invoice copies.

8—Return original order to files.

It will be seen that one single document, the "master," has progressively built up its information to become a complete history of the transaction in all its aspects. The customer receives a facsimile copy of this document.

Complete Success

Again, it was a complete success. Having passed through its various warehouse processes and being despatched by the shipping office to the invoice department, this original order master was then priced and extended, and put through the machine. We therefore produced an invoice which was partly typed but completed in manuscript.

I personally had many misgivings as to the quality of reproduction, and felt that although we were a business house, and not a professional office, we still did like to produce a decent looking document for submission to our customers, as an invoice. My fears, however, proved groundless, and with a little persuasion on the part of our invoice department manager and the co-operation of his pricing clerks concerning handwriting, figure-work and so on, we produced a final document which even my very critical chairman was prepared to accept as satisfactory.

We now have six machines; the system is working very well indeed and has enabled us to reduce our typing strength by 11 typists. Ultimately it will enable us to make even further reductions when we embrace the system to our entire order flow.

Many weeks of hard thinking, trial and error, and in many cases, disappointment, went into the perfecting of this idea. But I am absolutely convinced that when it is thoroughly established it will enable us to make savings of £5,000 a year in our overhead costs and be a much more efficient system than anything which could have been devised by other means.

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TO 3' 1½"

MODEL — IA
LIFTS 3 CWTS.
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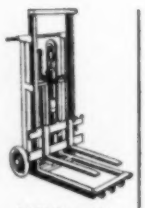
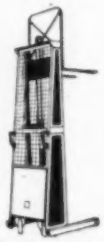

MODEL — III
LIFTS 7 CWTS.
TO 3' 9"


MODEL — IV
LIFTS 7 CWTS.
TO 6' 9"

HAND TRUCK
LOAD 3 CWTS.

Definac definitely..

said the Chief Accountant

I like a system that covers *all* the ground in the department. I can switch equipment from Pay Rolls to Ledgers, or from Ledgers to the Costing Office if need be, and their methods are so flexible, too. We can expand the system where we want to; only the other day we added receipts to the cash-book side of our sales ledger routine, and now we are introducing traders' credits—quite simple, really, same entry as the bought ledger debits.

Nothing too difficult for them, either. My friend across the road wanted fifteen interlocking forms, all different, to tie up his shipping accounts; DEFINAC did them for him with a smile, and delivered on the dot, too.

Our own system is quite simple, of course, stock rulings all the way, and so inexpensive.

Naturally, we use DEFINAC VISIBLE as well. Every card at one's finger-tips, never a card misfiled. Yes, it can be used for machine-posting, too, and the DEFINAC people even process your current cards in present use. You ought to have a look at it, really; it's most interesting.

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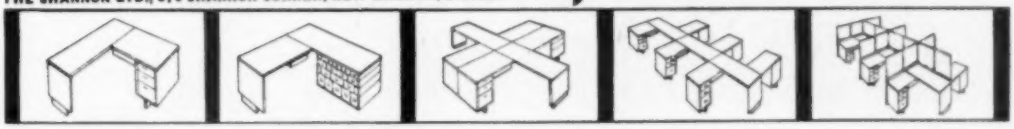

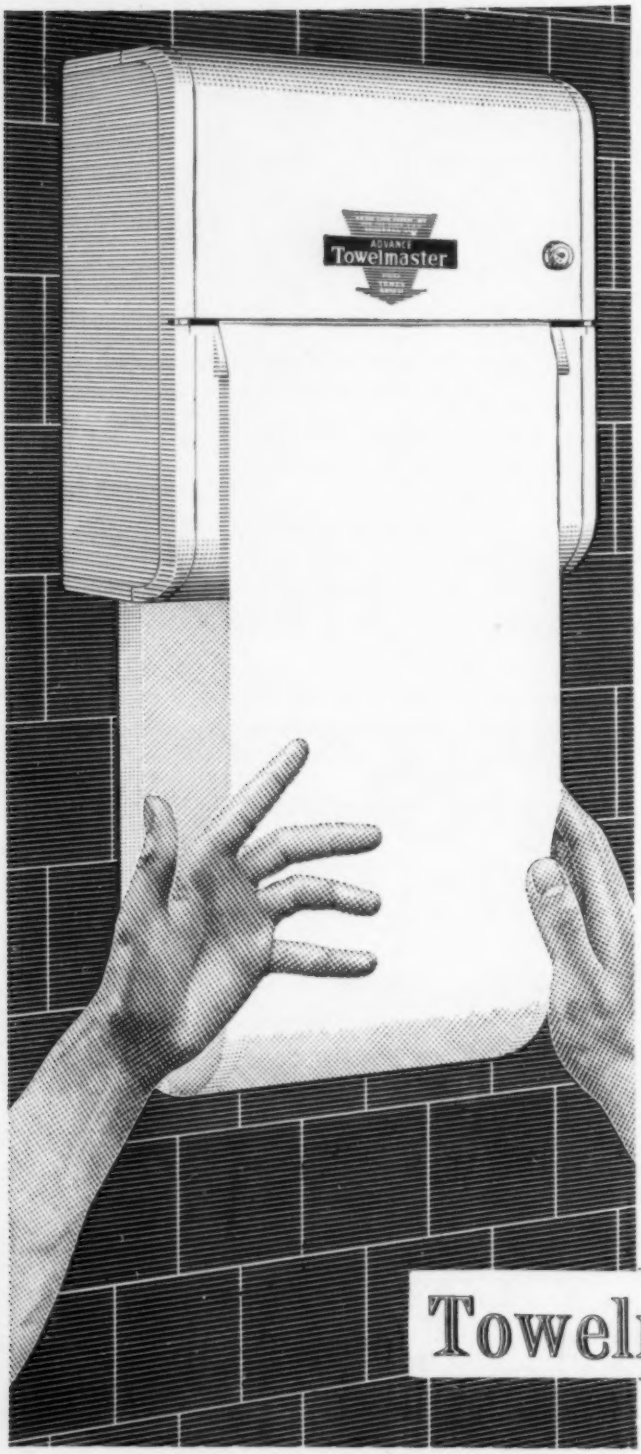

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Guide to 'NON-SLIP' DISCS

By DONALD F. FEATHERSTONE, M.C.S.P., M.E., L.E.T.

A practising physiotherapist explains here the causes of slipped discs, and the precautions which may be taken to prevent employees from exposing themselves unnecessarily to the risk of this type of painful absenteeism

ONE of the greatest disasters that has befallen harassed industry during the last few years has been the unprecedented prolapse of countless intervertebral discs. Once upon a time men strained the muscles in their backs, or by catching cold, developed lumbago, and after a few days in bed with their back well rubbed by a dutiful wife, returned to work rather ashamed than otherwise of their human frailty. But now every pain in the back is an interesting case fraught with grave risk—to be buckled in a confining corset, put into an uncomfortable plaster cast, manipulated, stretched or surgically explored. One famous surgeon has gone so far as to state publicly that, whereas a few years ago men would take a week off for lumbago and then return to work, now they have nine months' treatment and come back to a future of light work only!

It seems to be a recognized course to warn every one of these "backs" that muscular effort has fearful consequences. Against this particular evil they are given a magic charm—a "certificate for light work." In this respect, it is apparent that clinical medicine is out of sympathy with industrial requirements and no serious attempt is being made to bridge the gulf between the labour manager with his problems of placement, and the disc-happy surgeon.

Can this gulf be bridged? There is no reason why not, if the span of the bridge is erected on two foundations. On the one side is "Why?" and on the other side "How?" The surgeon must determine why the injury occurred; and industry, helped by the medical profession, must determine how it is to be avoided.

The "slipped disc," or to give it its full medical name—the prolapsed intervertebral disc lesion—is said by many experienced surgeons to be responsible for well over 90 per cent of all symptoms attributable to the lower back.

Why are they so common? Why is it a rarity for a patient to reach middle age without having developed painful symptoms at one or more spinal levels? Why does ordinary use of the joints of the spine cause pain so readily, when the other joints of the body can withstand life-long exertion without causing trouble?

The answers are undoubtedly connected with men's acquisition of the erect posture. The capacity to maintain equilibrium on two legs has outstripped the evolution of the spine. As soon as man learnt to stand up, the function of the spine altered, the strains of compression and of flexion were imposed on a structure not designed to withstand either.

The disc is a small cartilage separating the bones that go to make up the vertebral column. It acts as a shock-absorber to prevent jars being transmitted straight up the spine to the base of the brain. When it is "slipped" it is generally considered that one of these cartilages, usually in the neck or the lower part of the spine, has been crushed, fragmented or displaced. This causes pressure on nerves emanating from the vertebral column, resulting in the acute pain of lumbago or sciatica—sometimes both.

Protecting ligament

Normally discs are prevented from being displaced backwards by a ligament stretching down the whole length of the rear of the vertebral column, the normal curves of the back being developed to protect this ligament from excessive strain. The maintenance of this curve in the lower part of the back is the principal safeguard against disc protusion. In people with a flat spinal column, the disc has no such protection and it is noticeable that these people are more apt to suffer from backache than

Generations of physical education teachers and drill sergeants have endeavoured to produce in their charges a flat back—but this is the one posture that enhances the likelihood of backache

POINTS TO REMEMBER

1—*DON'T work off parallel feet*

2—*DON'T have the load too far forward*

3—*DO bring the load close to the body*

Drawings by Courtesy of I.C.I. Ltd.

those endowed with a normal degree of lumbar curve.

Generations of physical education teachers and drill sergeants have endeavoured to produce in their charges a flat back, considering that to be indicative of good posture, whereas in reality it is the one posture, the only one, that enhances the likelihood of backache! These same despots have also concurrently tried to make us a nation of supple-spined individuals capable of bending down and touching the floor, with straight legs.

Touching Toes

There is a sort of fetish amongst men that no one is healthy unless he bends to touch his toes a number of times each morning. Many disc troubles are the result of acting on this extraordinary idea. Even when the sufferer from backache finds that flexion exercises increase his discomfort, he congratulates himself on affecting the right spot! Those who can touch their toes are lucky; those who cannot must not force the trunk towards flexion. This is sometimes done under the mistaken impression that the hamstrings, the muscles at the backs of the thighs, can be stretched thus: they cannot, but the ligament protecting the disc can be stretched, with later disastrous results.

The signs of a "slipped disc" vary according to the type of lesion concerned, but a definite pattern emerges which can easily be recognized. In the early stages, or in those that remain minor, the characteristic feature is aching dependent on how much the patient exerts his back. Any work involving stooping causes sudden twinges or is followed by pain; he may experience difficulty in straightening up after bending or in getting up out of an armchair; turning in bed often causes a twinge enough to waken him, the back may ache again in the afternoon and evening after moving about has relieved the pain with which he arises in the morning.

The self-reducing disc, the disc that returns to its place of its own volition, causes the sufferer to wake comfortable, but when he stands pain comes on regularly in about 15 minutes and soon becomes so severe that he has to lie down. As soon as he does this, the pain disappears.

Recurring "Clicks"

Then there is the case in which the victim states that he bent down, but as soon as he came up he felt a click and was seized with agonizing pain, locking him in the bending position. After some seconds, or even minutes, he could straighten up cautiously, but with the pain aggravated by movement, by coughing and sneezing. He retires to bed and the pain gradually eases, until after days or weeks, he is symptom-free. He may remain so for a year or more, when a similar bending movement may set up the sequence again.

There remains the third case in which the patient carried on some heavy work involving much stooping and lifting, as at work or in laying a garden path. After a few hours he felt a slight backache but thought little of it. After sitting for an hour or two in his armchair that evening, he found that severe lumbago pain prevented him from rising. He struggled to bed and slept comfortably, but next morning found the slightest movement so painful that he was forced to stay in bed for a week or more—after which he recovered. Some time later came another attack.

A disc can be damaged by prolonged wear and tear; it may also suffer in an accident. In the latter case, where working conditions may fairly be said to have played a part, it will generally be accepted that the precipitating cause is injury. But should only a crack be caused in the disc it may not become complete for a year or two, and after it is complete many months may elapse before the victim makes the movement that brings about displacement. Hence a gap of weeks, months or years may separate the accident from its eventual, nevertheless direct result. This long interval between cause and effect creates great medical-legal difficulties, and patients can suffer financial hardship if the possibility of so long a latent period is not kept in mind.

Industry already has done quite a lot to eliminate or circumvent dangerous strains. When the nature of the work renders back strain particularly prevalent, methods have been adopted by custom which have been found to minimize the risk. One of the best examples is that of the coal

Those who can touch their toes are lucky; those who cannot must not force the trunk towards flexion

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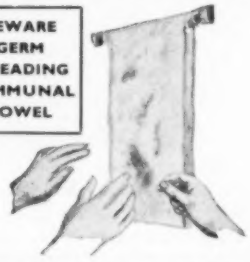

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Industry has already done quite a lot to circumvent dangerous strains—for example, the experienced coal miner lifting a tub with his hands behind his back

miner lifting a tub. The inexperienced man would risk "slipping a disc" each time he attempted this. But generations of miners have learned to avoid risk by the simple expedient of turning the back to the tub and lifting with the hands behind them. In this position the knees can be well flexed and the lumbar spine is held immobile until the actual lift has been initiated by the thigh muscles.

The M.O.s' role

Industrial medical officers can play their part by arranging that weights are presented to workers at a proper level, and by showing them how to lift safely. It needs to be more widely appreciated that the back is not a derrick, and that the legs are designed for lifting. The majority of accidents occur when the back is bent and the worker is making an effort to straighten it whilst lifting a heavy weight. The rules of lifting, which should be displayed in every factory and warehouse, are as follows:

(*a*) Stand close to the load.

(*b*) Take a secure grip.

(*c*) Have a firm footing.

(*d*) Bend the knees.

(*e*) Keep the back upright.

(*f*) Lift with the legs.

(*g*) Take a steady lift—don't jerk.

(*h*) Shift the feet to turn—don't twist the body.

In Canada, posters showing these points are issued by the Workmen's Compensation Board in an endeavour to protect heavy workers from "slipped discs." Since such an attack resulting from employment is clearly an industrial accident, medical officers can also save their firms much money by emphasizing these rules.

Workers occasionally learn tricks which afford them some protection from recurrence of their symptoms. For example, a mine worker (a panturner) found that he could avoid pain if all his lifts were made in two stages; he would lift a short distance and then, after a moment's pause complete the lift. In some cases it may be necessary for a patient to avoid exertion altogether for a time, and light work has to be ordered. If a man is engaged in heavy work and has had several relapses, he should be sent to a rehabilitation centre to learn a lighter trade. The patient must not be turned into a neurasthenic, afraid to make any movements other than those of the most cautious nature; but on the other hand he must learn to treat his mechanically imperfect joint with respect.

More Analysis Needed

Industry's method of selection, by trial and error, of suitable work for the "back" case is in most cases quite unsatisfactory. What is needed is a careful physical-functional analysis, in each case, of the man and the machine. Three main lines of research need to be carried out:

1. How to prevent threatened injury in the performance of a specific act. The majority of back strains and "slipped discs" will be avoided if the workman is properly instructed in the art of lifting.

2. How to avoid the act which is calculated to cause injury. It may not be easy to place in a heavy gang a man wearing the label of light work, but it should not always be quite so difficult to place him in the heavy gang with instructions to the foreman that, although he should do his full share of hard work, he should not be employed in lifting from knee level or lower. Many a man who has suffered from a "slipped disc" could resume his work at machine or bench without symptoms or fear of relapse if objects which he previously lifted from the ground level could be stacked at a height of from two or three feet.

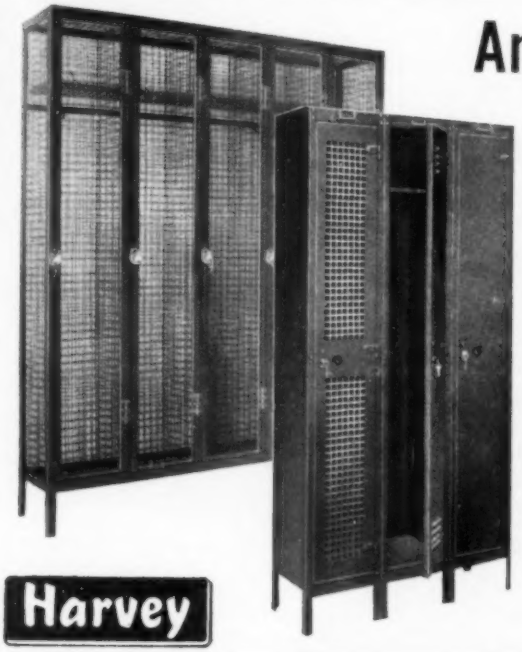
3. Correct selection of personnel for specific work. At present selection tests are used by the industrial psychologist to determine both adaptability and accident proneness. But the anatomist has also made a selection of types that are able to perform certain specialized manoeuvres more readily and more efficiently than others. This method was used in the war for picking naval anti-aircraft gunners, although no detailed research has yet taken place to determine the accident proneness of persons with particular types of physique, performing particular functions.

It has, for instance, been stated that the long thin type of man represents the "disc" type. But this is certainly not borne out in the normal run of cases, which include tall and short, slim and burly. Nevertheless, in cases of sudden "slipping" of a disc it has been considered that there may be some relation between the length of reach and the patient's height.

Bridging the Gulf

With "why" and "how" established, the foundations can be well and truly laid, so that only the span of good will is necessary to bridge the gulf. The benefits of liaison between industry and surgery in the case of "slipped discs," are not limited to those of higher productivity and better industrial morale. Together they have much to contribute to the general happiness of mankind.

Industrial medical officers can play their part by arranging that weights are presented to workers at a proper level, and by showing them how to lift safely



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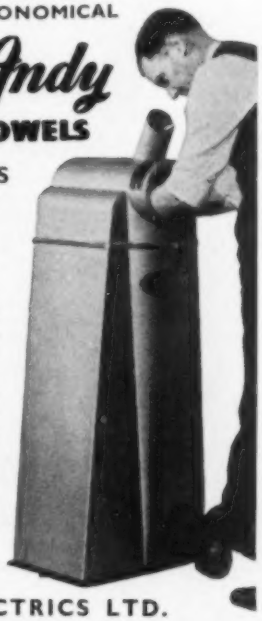

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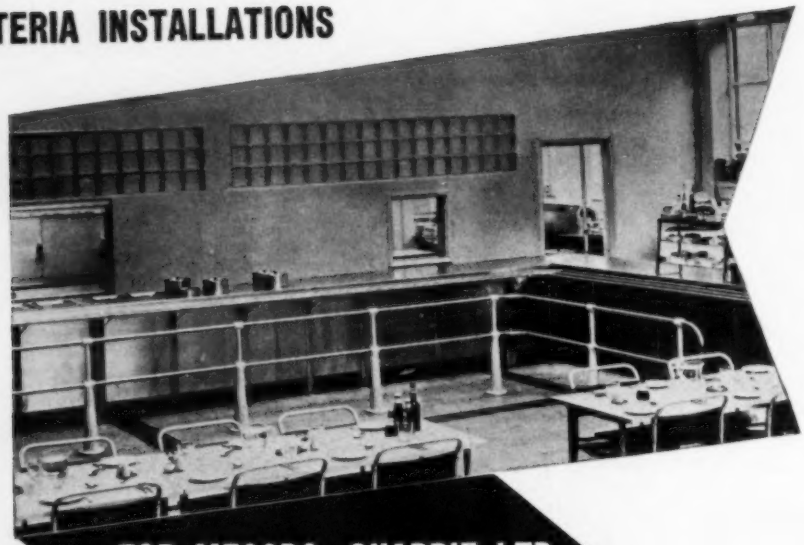

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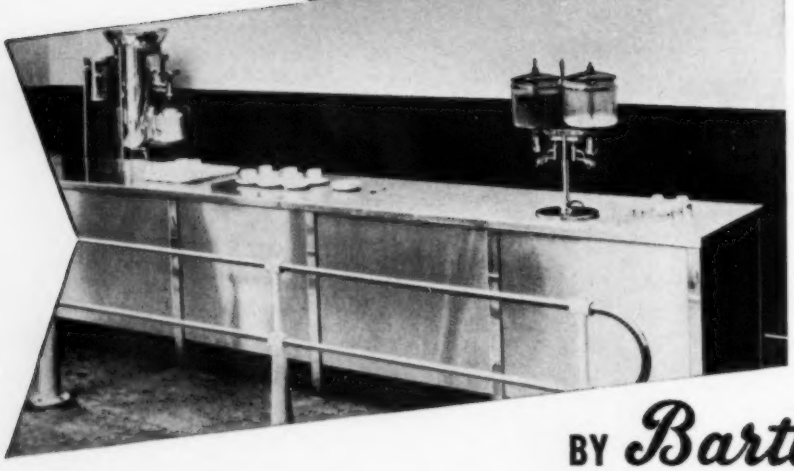

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This New Equipment Can Increase Canteen Efficiency

BUSINESS presents here a cross-section of new and improved appliances shown at the Hotel and Catering Exhibition, London

THE performance of an industrial canteen depends very largely on the type of equipment used there. In this month's article, the emphasis is all on new appliances which can add to canteen efficiency.

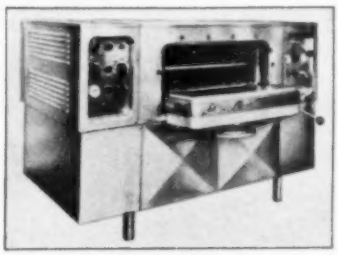
Briefly reviewed below are a number of items which were on show at the recent Hotel and Catering Show at Olympia. No attempt is made to catalogue thousands of different exhibits; these items are put forward as a cross-section which shows some of the latest trends and developments.

PRESSURE OVEN. The Swedish-made *Ovenator*, which made its world debut at Olympia, is an all-purpose oven which uses super-heated dry steam together with infra heat elements.

Food is cooked under pressure at temperatures of up to 900 deg. F., which reduces the cooking time and is claimed to more than halve the loss of vitamins incurred in cooking by conventional equipment.

The *Ovenator* can be used for steaming vegetables and puddings, for baking bread and cakes, and for steaming or roasting meat, fish and poultry. A 10lb. joint of veal can be cooked in 30 minutes with the loss of only 1lb. in weight; chickens can be roasted in five minutes; and potatoes can be steamed in 11 minutes.

The oven capacity is large enough to cook 50lb. of meat or 70lb. of root vegetables at once. It is practicable to cook both meat and vegetables together.



All-purpose Oven

Because the unit is extremely well insulated—most of the exterior surface remains cool—heat loss is negligible and a 25 per cent saving in electricity is claimed.

ROTARY TOASTER. More than 500 slices of bread can be toasted in one hour at a very low cost with the *King Toaster*, which uses flameless radiant-heat gas burners. Bread is

Constant Heat Unit

placed on rust-proofed racks which rotate through a toasting chamber, where both sides of the bread are exposed to heat. When the full cycle has been completed, the toasted bread is released into a chamber at the bottom; there it will keep warm until required for use.

The equipment has an anodized aluminium casing, and the conveyor assembly is driven by a chain and sprocket from a constant-speed motor. A handwheel is provided for actuating the conveyor independently of the motor.

An advantage of radiant heat—obtained by filtering a gas-air mixture through a porous ceramic tile—is that a constant even heat is obtained over the whole surface of the tile in a very short time. This cuts delays in waiting for the unit to warm up.

SNACK COOKER. Where some workers require quick meals at irregular times, the newly-developed *Adastra* snack bar unit is likely to be a particularly valuable piece of canteen equipment. Facilities for cooking almost every form of snack are incorporated in one modestly-priced unit.

It is constructed on a rigid welded steel framework, with the casing, work top, shelves and back screen in either aluminium or stainless steel. Two burning boilers on the right of the work top are fitted with luminous gas jets controlled by safety-type cocks with a spring lock in the off position, and a stop in the simmer position. Cast aluminium frets support the utensils.

The griddle plate, to the left-centre of the work top, is made of heavy steel with a polished surface and flared edges on the front and sides; the back edge is open for draining the cooking fat into an aluminium trough. The effective cooking area of the plate is 18in. by 10in.

Immediately below it is located a

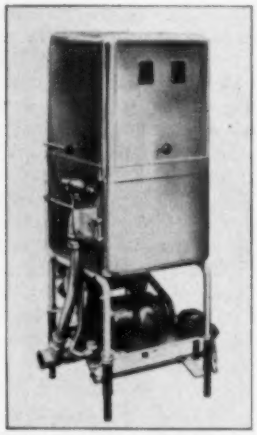
Everything for Snacks

hot cupboard in which 24 plates can be kept. On the left of the unit, as an optional fitting, is a deep-frying range incorporating a low temperature sediment trough and thermostatic control.

An eye-level griller and toaster is fitted to a shelf on the back screen. It incorporates a strong wire grill and a vitreous-enamelled cast-iron fluted drip plate with a fat trough in front.

QUICK DISHWASHER. Claimed to be the speediest dishwasher of its size on the market, the *Tornado* is made almost entirely from chrome-nickel stainless steel. Crockery or cutlery is fed into the machine on racks measuring 14¾in. by 14¾in.—and capable of taking 17 plates, 20 saucers, 16 teacups, 17 glasses, or 150 pieces of cutlery. The machine can handle 100 racks an hour. The racks glide into the machine on guides fitted with roller bearings.

The design recognizes the importance of easy cleaning. The 11-gallon tank has rounded corners; all pipes have been placed outside the



Automatic or Foot Control

machine; and three sliding doors give maximum access to the interior. The wash sprays can be removed for cleaning.

Powered by a 1 h.p. electric motor, the *Tornado* can be supplied to work fully automatically or with a foot-operated wash and rinse control. The rinse position of the foot lever is spring-locked to reduce the consumption of hot water.

SELF-SERVICE. Now being manufactured in this country, the *Kwik-Kafé* automatic coffee and chocolate machine differs from several models in this field in that neither the milk nor the coffee is stored in the form of powder or pills.

Coffee, chocolate, milk and sugar are all stored in unadulterated form. The coffee is brewed and then, by an

No Pills or Powders

automatic process, is frozen solid within a few minutes. The milk and liquid sugar are also stored in a refrigerator inside the machine until released by the insertion of a coin.

Each cup is made individually. The customer can select his drink simply by turning a pointer. There are five varieties to choose from: black coffee, coffee with milk, coffee with sugar, coffee with milk and sugar, and hot chocolate. The moment a sixpenny piece is inserted, the refrigerated ingredients are blended with almost boiling water. A paper cup falls into place and is filled with a cup of the chosen beverage.

The *Kwik-Kafé* stands 45½in. high, is 16in. wide, and 20¾in. deep. It can provide 150 cups of beverage at one filling, the paper cups themselves being stored in a transparent turret protruding from the top of the machine. A warning light goes on when the machine has been exhausted.

The unit is recommended for installation in factories, offices, and canteens where quick service without staff supervision is required.

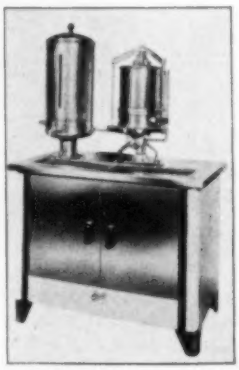
VERSATILE ESPRESSO. Adaptability to individual requirements is a feature which will commend the new *Express Connoisseur* coffee-making machine to canteen managements. This British-made espresso machine is so designed that the number of coffee-makers in the unit can be extended at will to meet increased demands. It makes 80 strong or up to 100 medium strength cups of coffee to the pound—the operation taking only 20 seconds per cup.

The *Express Connoisseur* is a small tubular fitment which works direct from a boiler. Occupying only a few inches of counter-space — the boiler is located underneath — it leaves plenty of room at counter height for serving or storing cups and saucers.

The unit is operated by a spring lever, which delivers the coffee through two nozzles. Before releasing the coffee, the lever is held by a special catch which allows the ground coffee to "pre-swell" for several seconds.

A quantity-control device can be pre-set to deliver coffee according to the size of the cup. It incorporates a triple-layer filter, the extreme fineness of which gives great economy in use and allows the most finely pulverized coffee to be used without grains spilling through into the cup.

PRESSURE BREWING. An economical method of preparing high-quality tea in bulk is provided by the *Still* tea brewing machine, shown for the first time at Olympia. Uniformity of strength and maximum extraction is ensured by this machine,



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which requires only three to four ounces of leaf to make four gallons of tea.

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Continued on page 154

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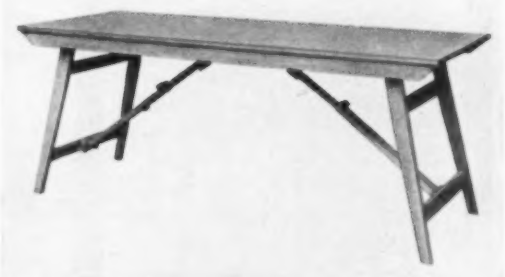

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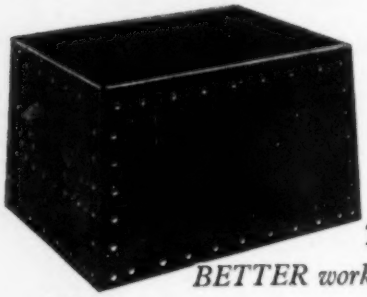
Fibre Board BINS, TRAYS and Boxes mean lighter work for your staff



That means BETTER work for YOU!

Yes, they'll work better without the fatigue of carrying or stacking heavy boxes. Fibre Board is the answer! Light, yet strong, ENFIELD Boxes, Bins and Trays are especially appreciated by female workers—an appreciation they will show in increased productivity.

ENFIELD
BOX COMPANY LIMITED

Queensway, Enfield, Middlesex **Phone: Howard 1888 (2 lines)**

HEAVY DUTY ELECTRIC COUNTER

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This model has been designed to meet applications requiring a robust counter where the coils may be left energised for indefinite periods. Write for details of this and other mechanical and electromagnetic counters.

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This was *ONCE* a business problem!

Holding on for connections, repeating conversations—tied to a telephone. All these meant loss of time, money and efficiency **EVERY** time you used a **TELEPHONE**

No repetition of conversations when two or more people are together

Doubles her efficiency . . leaves both hands free for switchboard operation

Leaves you free to refer to files whilst the receiver is still on the FONADEK

A Fonadek by the 'phone guarantees increased efficiency, eliminating up to two hours wasted time each day. The Receiver (G.P.O. or internal telephone) is placed on the Fonadek, it is then possible to speak and hear freely whilst carrying on normal work.

Everyone in your business from Executive to Telephone Operator needs a Fonadek.

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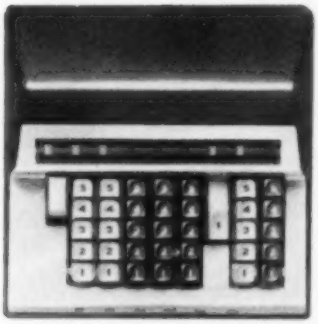
Just write Fonadek on your letterhead for our brochure

FONADEK (BRANSON) LTD. Dept. B, Vivian Road, Birmingham 17. 'Phone: HARborne 2267/8

Branches and Agents throughout the British Isles

Visit us at the Factory Equipment Exhibition at Stand D.30.



LIBERTY'S use the CONTEX

Liberty's: the world famous store in London's Regent Street, naturally use only the finest equipment in their offices.

Despite the complicated machinery used in their up-to-date accounts dept., Contex adding machines play a useful supplementary role in the stock rooms. In *your* business too, you will find the handy, portable Contex the perfect answer to your figure problems. Why tire yourself out when you can use the inexpensive Contex for so many jobs? Remember—a mistake can cost you money, years of goodwill and future business, but a Contex only costs £18 12s. 6d.

Models		Capacity				
	S/1		£99,	999.	19.	11½
	S/2		£999,	999.	19.	11
	Decimal			999.	999.	999.

Prices of all models, £18. 12. 6

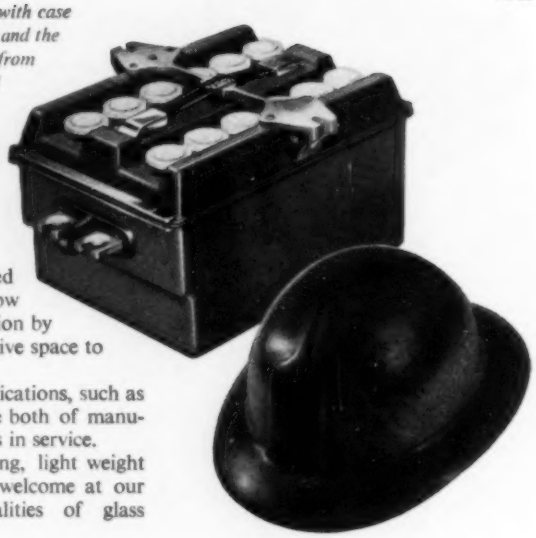
Have a free trial of the Contex in your own office; see your local dealer, or in case of difficulty apply direct to:

OFFICE MACHINERY LTD., OMAL HOUSE, KINGLY ST., LONDON, W.1. *Tel. Regent* 8833/7

(The Specialists in Adding, Calculating and Dictating Machines)

NP33

Illustrated are the Varley Aircraft Battery with case and lid made from glass reinforced plastics and the Panorama Industrial Safety Helmet made from the same material—both using the moulded pre-form method.



strong as glass

After the usual development period, glass reinforced plastics are getting into their stride. At Walthamstow we have established our plant for quantity production by the moulded pre-form method and new buildings give space to develop the "laying-up" of large formations.

The regular production of sound industrial applications, such as those illustrated here, give us a unique experience both of manufacturing methods and the behaviour of products in service.

Manufacturers needing large quantities of strong, light weight components with very special characteristics are welcome at our Walthamstow works to discuss the potentialities of glass reinforced plastics.

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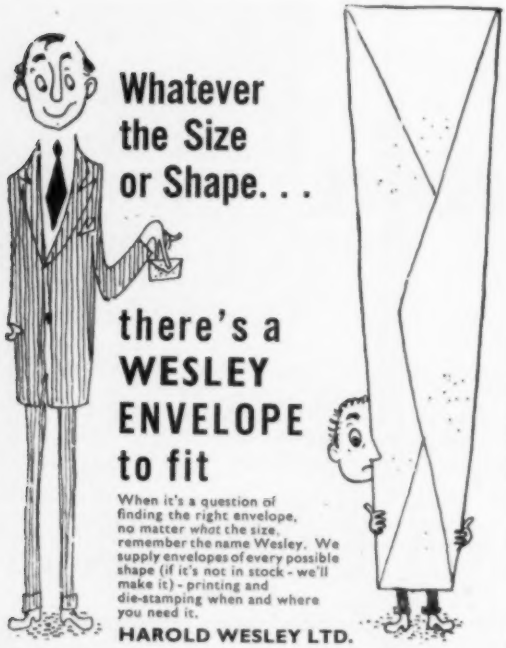
NATIONAL PLASTICS (Sales) LTD.
Sales Organisation for BRITISH MOULDED PLASTICS LTD., Avenue Works, Walthamstow Avenue, London, E.4.
LARkswood 2323



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there's a WESLEY ENVELOPE to fit

When it's a question of finding the right envelope, no matter *what* the size, remember the name Wesley. We supply envelopes of every possible shape (if it's not in stock - we'll make it) - printing and die-stamping when and where you need it.

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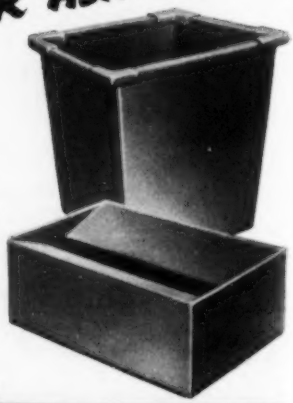

Write for illustrated leaflet

F.C.BROWN · BISLEY · SURREY
FOR STEEL OFFICE EQUIPMENT

'I can give you just 2 minutes' said the busy man

The salesman replied:

'The DIMAFON Dictating Machine improves your work and is extremely simple to use. Each double-sided magnetic disc records the equivalent of 16/20 normal-sized letters. The DIMAFON records both sides of telephone conversations, is portable and can be taken home for evening work. Both rigid and flexible discs are provided — the latter can be posted.'

In AUSTRALIA, SWITZERLAND and WEST GERMANY, the DIMAFON Dictating Machine outsells all other makes.

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Test a DIMAFON for 14 days without obligation. Write or telephone:—

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Tel: TRA 6655

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RONEO

and do the job

PROPERLY

FOR YOUR OFFICE

Push-button Copies

TO justify the minute reproduction detail which can be obtained with the new *Electro-Rex* electronic stencil-cutting machine, the manufacturers have also produced the *Rex-Rotary* duplicator. With this machine, 5,000 copies or more can be reproduced from a normal typewriter stencil, or 10,000 copies from an electronic stencil. In each case, the

Automatic ink supply

copies are produced fully automatically, the machine supplying itself with exactly the right amount of ink for each copy, and shutting itself off when the job has been completed.

The machine starts at the touch of a button. Inking is adjusted by a selector dial and is operated by a piston which compresses an ink drum. The special double-action synchronized paper feed is so accurate that a document can be run through more than once, to produce multi-coloured copies with precise registration.

Any grade of paper, from lightweight tissue to postcard stock, can be fed into the machine. It prints right to the edges of paper 8½in. wide and up to 13½in. deep on the sheet.

When using colour, an ink-can is inserted and a selector dial is pre-set to the correct degree of inking. While the machine turns, a pre-measured supply of ink is fed into the cylinders, assuring uniform impressions regardless of whether the run is for 50 or 5,000 copies.

To enable art or glazed paper to be used successfully, an automatic interleaver, which works off the roller axle, drops a blank card in between the sheets as they fall into a receiving tray. This effectively prevents smudging.

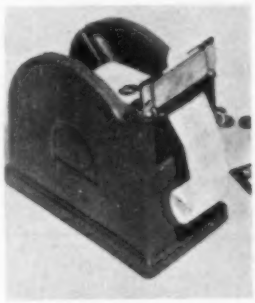
Any employee can operate the machine after only a short period of instruction. Once the machine is running, no supervision is necessary, except in the case of long runs where a continuous supply of paper has to be maintained. A bell rings when a new ink cartridge has to be inserted.

Enquiry Ref. No. O.3/1

Label Dispenser

ALTHOUGH intended mainly for use in stores and factories, the *Tickotab* label dispenser has applications in the office. It provides a speedy means of despatching specially-prepared self-adhesive labels.

Tickotab labels are supplied in sheets or reels to specified designs, and can be used for marking, coding, colour identification, pricing, advertising, sealing, and masking. They have an adhesive surface which requires no moistening and sticks instantly to all dry surfaces, including metal, glass, porcelain, film, plastics, and paper.



Labels in strips

Reels of labels fit into the dispenser, which incorporates a gate arrangement for stripping off the backing paper, leaving the label ready for immediate use. Two models are available, for labels up to 2½in. wide, and up to 4½in. wide.

Enquiry Ref. No. O.3/2

Effortless Dictation

A HIGH-FIDELITY amplifier circuit has been incorporated in the new *Model TN-3 Rex Recorder* dictating machine, which had its first showing in this country at the Business Efficiency Exhibition. The model is basically the same as its predecessor, however, using unbreakable plastic discs as the recording medium.

The improved performance provided by the new amplifier gives an unusually high quality which is normally associated only with music reproducing machines.

High-quality dictation

This, claim the manufacturers, makes for effortless transcription and dictation, and helps to eliminate mistakes.

Another new feature is an automatic indication device which is operated by two buttons—one to denote the length of correspondence, and the other to denote corrections or additions.

Recording is via a hand microphone which incorporates a spring stop-start

★ **Equipment included in this survey is selected for its news value alone. The names and addresses of the manufacturers or distributors of items mentioned can be obtained by writing to the Editor, BUSINESS, Mercury House, 109-119 Waterloo Road, London, S.E.1, quoting the appropriate reference numbers. Manufacturers are invited to submit details of *new* and interesting products for consideration. An original photograph should accompany each item submitted.**

switch and a button for continuous dictation. The microphone can also be used to hear the play-back, but headphones are available for typists.

Up to 12 minutes' dictation can be taken by the recording discs, which can be used indefinitely. Light and pliable, they can be filed for any length of time or sent by ordinary letter post. Special folders are supplied to contain the discs, together with letters under reply, when they are routed from the user to the typist. Discs can be set on the machine so that transcription starts at any predetermined point.

The *Rex Recorder* is portable and weighs 20lb. complete with case.

Enquiry Ref. No. O.3/3

Misfiling Eliminated

INSTANT location of information is provided by the *Visipost* visible records system, which made its debut at last month's Business Efficiency Exhibition. Cards with angled corners are arranged in trays in echelon fashion so that the angle—on which the title is entered—and one vertical edge for vital information remain visible.

Misfiling is virtually eliminated by an "out" signal which appears automatically when a card is removed from its position. This indicates the home of any card—even when the file is closed.

Each card has a slotted base which fits securely over holding rails built into the trays. The contents of the trays are protected by special guide spacers with transparent top edges to ensure speedy reference and a permanent orderly appearance. By merely adding extra guide spacers or sub-spacers, completed banks of cards can be extended immediately at any desired point, without disturbing continuity.

Visipost cards can be varied in size and design to accommodate alphabetical or numerical classification in almost every phase of office and accounting records. By using a range of coloured signals, vital information can be visually sign-posted, section by section. End cards are provided to indicate that a bank is complete up to a given point.

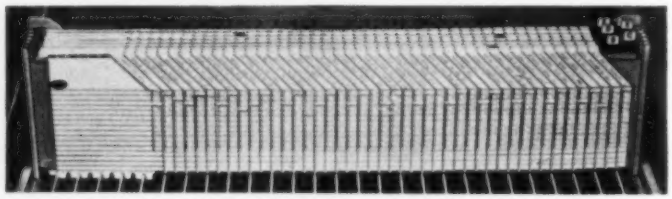
The trays, which may be supported by neat mobile stands, have plastic dust covers, although steel locking lids can also be supplied. The standard unit holds a normal maximum of 2,000 cards measuring 6in. by 5in.

Enquiry Ref. No. O.3/4

Up To Five Copies

THE *Elite Tru-Pak* record register is designed to produce, at one writing, up to five clean unalterable copies, plus the original written entry, not as stated in the February issue of BUSINESS.

Incorporated in the register is a steel writing table which provides a smooth



Instant location visible records

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for full details or demonstration:

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WITH THESE UNIQUE FEATURES:

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★ *Key setting with proof dials.*

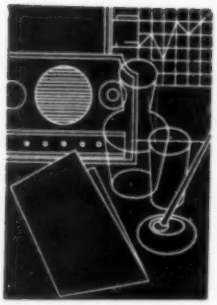
★ *Single hand operation.*

★ *Automatic dividend tabulator and division alignment.*

★ *Reverse switch for negative division.*

★ *Tens transmission throughout.*

KEEPING UP WITH MODERN TRENDS



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Are you losing profits through lack of information about your business ?
Are you losing valuable time and money trying to obtain this information ?
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We suggest that if the answer to any of these questions is in the affirmative, then the complete answer to your problems is "FINDEX"
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An envelope like this will carry a true-to-life illustration of your product right into the hands of potential customers. The realistic PHOTOPRINT design, reproduced all over the *back* of the envelope in any one of a number of attractive colours, simply cannot be missed.

Many well-known concerns use PHOTOPRINT envelopes with great success. It is not a costly business — just the reverse — and the reward for the small extra expense surprises everyone. Talk it over with your printer. In consultation with him — and entirely without obligation — we will prepare a sketch. Or write for examples of PHOTOPRINT in action to :—

John Dickinson & Co. Ltd.

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APSLEY MILLS, HEMEL HEMPSTEAD, HERTS.

Please send examples of PHOTOPRINT in action.

Name .....

Address .....

.....

My usual Printer or Stationer is

.....

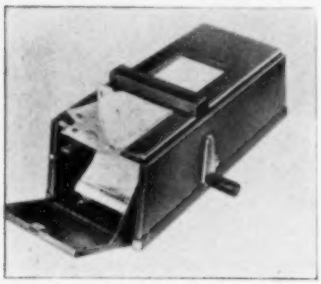
writing surface and ensures completely legible copies.

One or more copies can be retained under lock and key in a security compartment at the front of the register. These copies are folded in continuous book form so that it is possible to refer speedily and easily to any entry in the pack.

Enquiry Ref. No. O.3/5

New Counter Register

THE new *Manifoldia* autographic counter register contains provision for the automatic operation of a cash till. Multipart sets of forms are inserted in continuous packs. A hardened steel impaling pin punches alternate forms and advances the requisite copies to a locked security compartment. This method, claim the manufacturers, ensures accurate stacking and increases the capacity of the security compartment.



Continuous form register

The punched holes are used only for keeping perfect registration, and as the forms are not pulled along by them, there is no distortion. Registration is so good that, should the register be loaded with the first set out of line, the machine will automatically bring the forms into alignment at the first turn of the actuating handle.

The mechanism has been designed to give simple positive action with a minimum of moving parts. The body of the register is made from pressed steel, and is elegant in shape and finish. Two sizes are available—for forms measuring 6in. by 4in., and 8in. by 5¼in.

Enquiry Ref. No. O.3/6

Recorder Trolley

THE *Domain* model *ST-3* mobile trolley has been specially designed to accommodate the *Stenorette* dictating machine. Constructed with a tubular steel frame, the trolley has a top shelf on which the recording machine is placed at a convenient height for comfortable use.

Dictation on wheels

Immediately beneath is a cupboard with a shelf for stationery, and a lower compartment in which the machine's accessories can be stowed.

Reel dispensers for used and unused reels of recording tape are built into the lower cupboard shelf, and are enamelled red and green to avoid confusion.

The microphone fits securely into a clip when not in use, and cleats are pro-

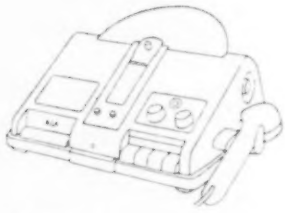
Invest Wisely

get an

AGAVOX

dictating

machine



There are only 4 basic questions when it comes to selecting a business dictating machine :

1 DOES IT DO WHAT YOU WANT
2 IS IT DEPENDABLE
3 DOES IT OFFER MAXIMUM EFFICIENCY
4 IS IT ECONOMICAL

There is only one answer when it comes to buying a business dictating machine—
THE AGAVOX

The running costs of the Agavox are negligible. The very long-life discs can be used many thousands of times. It is simple to use both for dictation and transcription. Small and light, it takes up very little space. It includes accurate "pin-point" indexing of dictation.

Write or telephone now for details, a demonstration or a free trial . . . without obligation

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ADDRESSING MACHINES
HAYWARD LIMITED

62 BRITTON STREET
CLERKENWELL ROAD
LONDON, E.C.1 *CLErkenwell* 5961-2

vided for stowing the mains cable when the equipment is being moved. A typewriter can be accommodated on the bottom shelf of the trolley. Free-running castors enable the trolley to be moved effortlessly.

Enquiry Ref. No. O.3/7

Defeats Forgers

THE new *Todd Model 60 Protectograph* cheque-writer has been designed for firms whose volume does not justify the purchase of one of the more expensive models in this manufacturer's range. Nevertheless, it combines maximum security with speed and legibility.

Forgery-proof cheques

After the cheque has been inserted, the required amount is selected by means of levers sliding in figured scales, and the actuating handle is depressed. As a safeguard against error, the amount appears in windows at the top of the dial. Guides are provided to locate the cheque; for writing on large documents, such as vouchers or cheques in sheets, the paper can be rolled into a cylindrical cavity at the back of the machine.

The same amount can be repeated indefinitely without re-setting. Only a complete stroke of the handle will operate the machine.

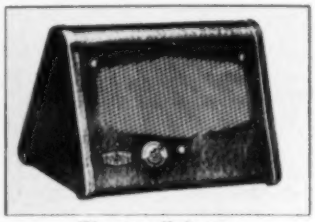
The amount appears on the cheque in bold, clear figures, so designed that they cannot be altered by penmanship. The paper is shredded and impregnated with an indelible ink which cannot be washed out by mechanical or chemical means. There are no blank spaces, no matter how short the amount line, thus preventing the addition of extra figures. The prefix "The sum of" automatically moves into position in front of the first figure of the pounds. Spaces between pounds, shillings and pence are automatically filled in by a thick hyphen.

Enquiry Ref. No. O.3/8

Direct Communication

THE new *All-Master* intercommunication system differs from previous models made by the same firm in that it permits direct communication between one sub-unit and another, as well as between the master set and sub-units.

To ensure that installation is still simple, a special lightweight colour-coded cable is supplied—five-cord for up to four-way communication, and seven-cord for up to six-way.



Six-way link-ups

One of the main advantages claimed by the manufacturers is that the *All-Master* does not use either valves or an electric mains supply. Power comes from two batteries which, on the average, last from four to six months.

Enquiry Ref. No. O.3/9

MORE for your money

more time.
more space. more speed.
more files with TIPDEX Systems.
more efficiency.

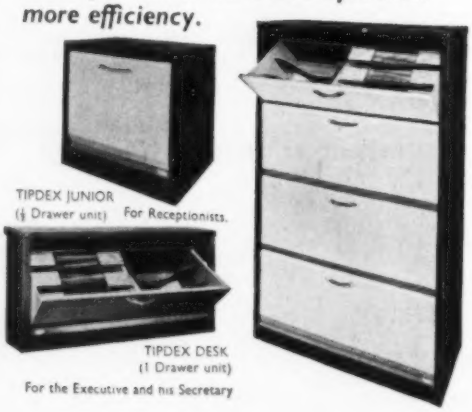
AND SAVES YOU HALF ITS COST PER DRAWER.

Neat compact Tipdex cabinets fit into spaces where ordinary filing cabinets just won't go—carry 50% more files per drawer with the Tipdex systems than with the normal suspension files—yet give full fast visibility even with all drawers open at once. Tipdex cabinets can be used in rows or banks anywhere, even in corridors, for fully opened they take only 19 inches of vital space as against over 42 inches with ordinary cabinets. Tipdex can't topple—there are no working parts to wear out—fully locking and dustproof—an entirely new angle on fast modern filing.

Ask your dealer for details or write direct to

TIPDEX LIMITED

1 Castle Court, Birchin Lane, London, E.C.3.



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NOW turn to page 42 for other modern postal aids

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. . . she has been promoted to an Imperial Standard '66', she notices that she gets through more work during the day and pulls the cover over her machine more punctually at the end. Very friendly machine, the Imperial '66'. To do a girl's work for her, neatly, quietly and tirelessly . . . that's true friendship.

And that's the Imperial '66'.

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Imperial

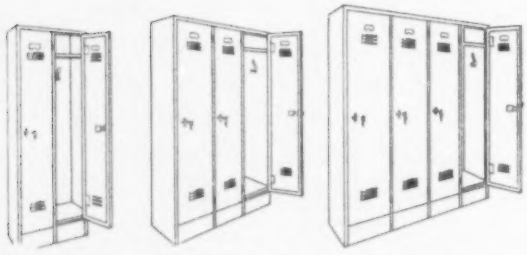
typewriters

IMPERIAL TYPEWRITER CO. LTD. LEICESTER AND HULL

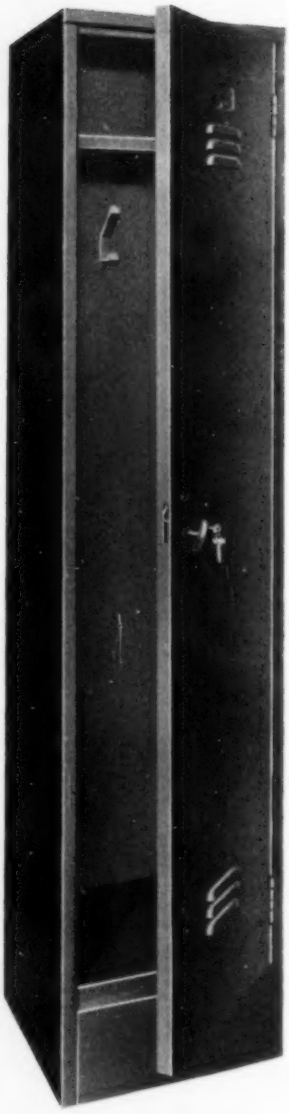
Pam's lost her purse

For the avoidance of incidents, suspicion, and in the interests of efficiency you should install Rubery Owen steel locker equipment.

Supplied in a variety of sizes, single or in nests, these lockers are a special product of the Industrial Storage Equipment Division of Rubery Owen. Write for full particulars.



Nest of 2 Lockers | Nest of 3 Lockers | Nest of 4 Lockers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Leaves both hands free

delivers the gumstrip to a pre-determined length. Two lengths can be set from 6in. to 50in. The machine can handle any width of gumstrip up to 4in., in rolls of 600ft. or 800ft., wound gum inside.

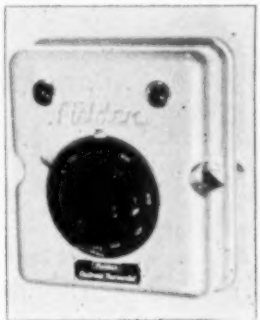
It measures 19½in. long by 11⅞in. high by 10½in. wide, and weighs 61lb.

Enquiry Ref. No. F.3/1

INSTRUMENTS

Temperature Control

A NEW electronic precision thermostat is designed for applications which demand high sensitivity and accuracy, combined with long-term stability. It is, however, a compact and robust



For workshop or laboratory

piece of equipment, suitable for use in industrial workshops as well as in research laboratories, etc.

A high-grade rapid response resistance bulb is used as the temperature sensing element. It forms one arm of an A.C. bridge, the out-of-balance being amplified by a high-grain, phase sensitive amplifier. The output from this operates the relay.

In use, the instrument is connected to A.C. mains and the calibrated dial is turned to the desired temperature. No further attention is necessary, unless it is desired to alter the control point. A change of 0.1 deg. C. on either side of the pre-set temperature value is sufficient to operate the relay for alarm or control action. Two coloured indicating lamps are fitted on the front of the case.

The instrument is available in ten standard ranges up to 500 deg. C. or 932 deg. F. The incorporated relay is rated at five amps 250 volts 50 cycles non-inductive load or 250 volts 1 amp D.C.

Enquiry Ref. No. F.3/2

INSPECTION

'Screened' for Faults

MANUFACTURERS of the *Enbeeco* profile projector claim that its use avoids tedious methods of examining small parts. The unit projects magnified profiles of small parts, screw forms, etc. on to a screen.

The objects are placed on a platform, situated at a right-angle to the optical axis of the projection lenses. Aluminized surfaced mirrors throw their image on to the screen. The platform may be adjusted longitudinally or laterally by micrometer adjustment.

The projection lenses are achromatic and give magnifications of x10 or x15. They are mounted on a slide so that the removal of one lens and the insertion of another is obviated. Objects up to ¾in. diameter are covered by the x10 objective, and up to ⅜in. diameter with the x15 objective. The surfaces of the mirrors are aluminized with quartz-hardened coating, so that the surfaces are not damaged during cleaning.

Maximum height of work which can be accommodated is 1¾in. for x10, and 1½in. for x15 magnification. The screen takes the form of two sheets of glass, between which a sheet of plastic tracing film is sandwiched. This not only obviates any need to frost the glass screen, but also permits an enlarged

Can be used as a comparator

drawing of the profile to be made on the tracing film, so that the projector can be used as a comparator.

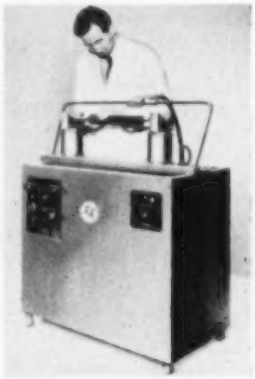
The projector allows rapid and accurate inspection by comparatively unskilled operators. It is portable and robust enough to withstand hard wear and tear on the shop bench.

Enquiry Ref. No. F.3/3

New Flaw Detector

A NEW magnetic instrument detects cracks and flaws in ferro-magnetic bodies such as engine cylinders, crankshafts, spindles, etc. The detection is carried out by applying a magnetic field to the workpiece through the support coils, followed by a magnetic ink specially suited to the component under inspection. The magnetic field thus induced is intense in relation to the current consumption and quickly reveals any cracks or flaws.

A useful feature is the facility for removing the residual magnetism from the component after inspection. This arrangement also assists in the removal of the iron particles normally present in the testing liquid, resulting in quicker



Cracks quickly revealed

cleaning of the component after inspection.

The coil supports may carry the component directly or through removeable bearing blocks — blocks of different shapes can be used for different components. One of the coil supports is fixed and the other slides in a guideway so that the distance between the supports may be adjusted to suit components of varying lengths.

The testing fluid is sprayed on to the workpiece by a pump unit housed in the base of the unit. The spray and the support bar are adjustable to any position.

Although the equipment is portable, on occasions it may be necessitous to test an object which is normally inaccessible. In such cases, a small hand unit is available for use in conjunction with the main equipment.

An attractive feature of the equipment is the very economical operating cost. The current consumption when connected to the mains is 3 amps. for magnetization and 4 amps. for demagnetizing.

Enquiry Ref. No. F.3/4

MATERIALS HANDLING

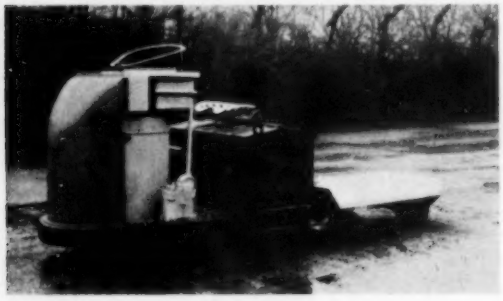
Flameproof Truck

A FLAMEPROOF battery electric truck for all commercial purposes has been designed primarily for use in areas where explosive or inflammable materials are present—paint, chemical and plastic plants, ammunition depots, oil refineries and airfields.

To the normal advantages of electric trucks (cheapness of operation, long life, silent running, and freedom from poisonous fumes) have been added a number of safety features. These include an automatic over-load circuit breaker, and a charging socket cut-out. The battery consists of 12 lead acid cells enclosed in a steel box, which is amply ventilated.

The truck, based on the same manufacturer's standard industrial truck, has a payload of one ton and a turning radius of 6ft. 3in. One important difference is that the control gear and motor of the new truck are totally enclosed.

Enquiry Ref. No. F.3/5



Safety features include an automatic over-load circuit breaker and a charging socket cut-out

Electric Hoists

A NEW range of electric hoists covers every load rating from 2½ cwt. to 10 tons. Lift heights and speeds are available to meet most requirements.

Covering a range of from 5 cwt. to 2 tons, the *Munck* model *No. 221* is fitted with push travel trolley, and is claimed to be one of the lowest-priced on the market. The *223* model covers

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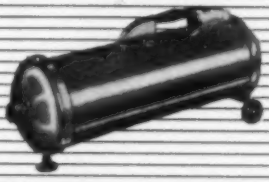

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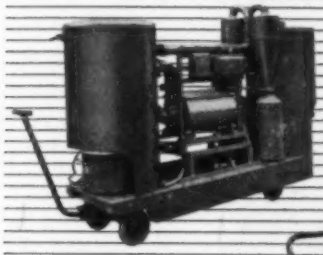
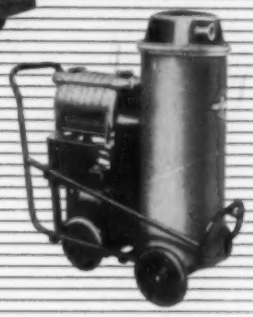


MODEL T87. Designed for flue cleaning Lancashire and other large boilers, furnaces, and gas works retorts. Handles heavy, smouldering or red hot dust.



MODEL T23X. An extremely compact but powerful general-purpose machine for factory use. Cyclone top to prevent filter clogging. A ball valve can be fitted if required for collecting liquids.

a range of from 30 cwt. to 6 tons and has an additional pendant controller for operation of the motorized trolley for power travel.

The hoists are of all-steel construction and are enclosed in a steel housing, with the motor assembled inside the drum. The motor is of tapered-rotor construction and automatically engages or releases the brake, which is coupled directly to one end of the motor shaft. The gearbox, brake and electrical contacts are all enclosed, but provision is made for ready access to all parts for maintenance.

Handchain or power travel

A rope guide encircles the drum and ensures that the rope winds correctly in the drum grooving. The rope guide also actuates a limit switch to prevent overwinding and over-lowering.

Every size of hoist can be supplied either for fixed mounting, or with trolley carriage. The trolley can be arranged either for push travel, or geared for handchain travel or power travel.

Enquiry Ref. No. F.3/6

HEATING

Automatic Oil-fired Boiler

THE *Kieft* fully automatic oil-fired boiler is fitted with a self-lighting oil burner with an output of 65,000 B.T.U.s. The boiler provides instant hot water and will heat up to six radiators.

It needs no attention whatsoever. When the water is hot, the burner automatically extinguishes itself, relighting itself when required. The special design of the heating surface and the steel waterway (with cast-iron casing) contribute greatly to the overall efficiency.

Robustly constructed, the boiler is suitable for installation in small office blocks, small factories, shops, warehouses, etc.

Enquiry Ref. No. F.3/7

MACHINE TOOLS

Versatile Lathe

THE *Cardiff* 10½in. S.S. and S.C. lathe is suitable for both production and toolroom work. The headstock is oil-immersed and pump-lubricated, and the final drive is transmitted through an independently mounted pulley, thus avoiding spindle deflection. Back gears are engaged by an internal gear clutch, and drive gears are hardened and ground.

The hollow spindle is mounted on twin opposed precision taper roller races at the front, and a parallel roller race at the rear. Vee belts can be replaced without disturbing the spindle preload.

Input and output drives of the nine-speed gearbox — by Vee rope — are quickly adjustable, and the gears are rounded for easy engagement. Eighty gear changes are available, while English

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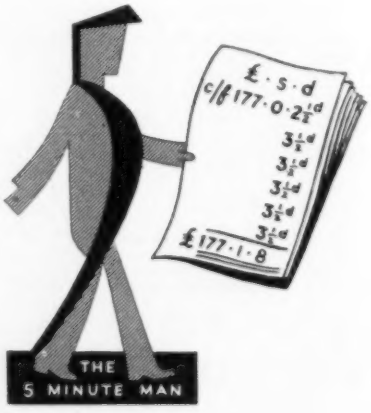

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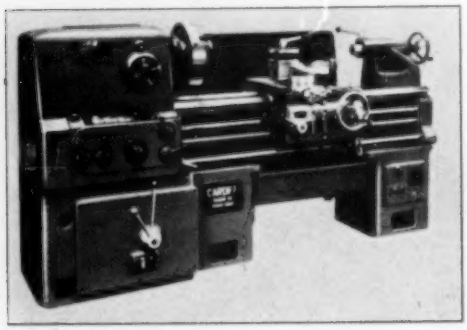
The apron has a patented snap-action control, and there is a safety feed overload clutch. There is also a safety interlock between the longitudinal feed and the screw-cutting motion. The saddle and tool slide give a maximum bearing area, and the gib strips are adjustable. There are two types of bed and tray; a gap bed (giving greater work capacity), and a chip flow bed (giving ready chip clearance). The width is 1¾ times the centre height.

Enquiry Ref. No. F.3/8



Final drive is transmitted through an independently mounted pulley, thus avoiding spindle deflection

FINISHING

Alloy Paint Container

THE shell and cover of a new 2-gallon pressure paint container are of high tensile aluminium alloy diecasting. This reduces the container's weight and gives a perfectly smooth surface both inside and out, making cleaning a simple matter —an advantage when the container is used for a variety of coloured paints.

The cover is held in place by forged steel C-clamps and handscrews. All parts in contact with the paint are of aluminium alloy or stainless steel.

Smooth surface—easy cleaning

The container is available with or without a pressure-reducing valve unit which is flange-mounted on the cover and houses the shrouded pressure gauge. It has a built-in safety valve which has an easing ring, so that it can be used as a blow-off valve, and is non-adjustable.

All containers are for a maximum working pressure of 50lb. p.s.i. and are hydraulically tested to 100lb. p.s.i.

Enquiry Ref. No. F.3/9

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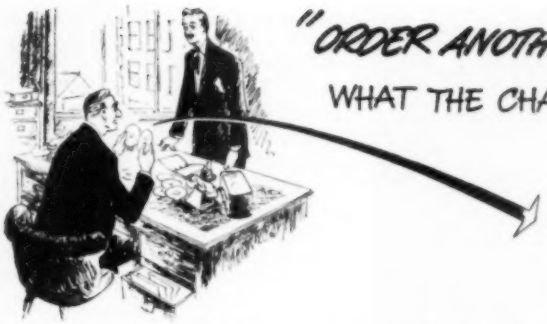

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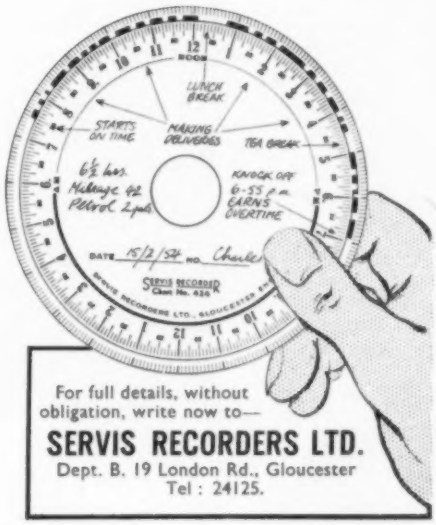

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APPRENTICESHIP TRAINING

Continued from page 106

tial ability. A similar report in less detail is prepared for parents.

At the end of their training, apprentices are expected to pass practical tests, and an E.I.A.G.A. certificate of apprenticeship, on which details of training and examination results are endorsed, is awarded by the committee to all satisfactory apprentices.

The cost of participating in the scheme has been kept as low as possible. A fee of £5 is payable, on registration, by a participating company, and then £3 10s. a month is payable in respect of each apprentice. This covers the cost of administration.

Wages of apprentices are paid by the firm for whom they are currently working. The ultimate goal in this respect is for the committee of each local group to standardize the rates of pay. So far this has not been achieved, but the firm currently employing an apprentice pay him at the rate he would receive if he were working for his parent company. It is normal, too, for the sponsoring firm to reimburse the apprentice for any additional expenses — mainly travelling — incurred while working for other firms within the group.

The firms who comprise the West London group cover a wide field of engineering, from sheet metal working to precision instrument making, and they vary in size from 20 employees up to 500.

The group chairman is D. A. Gunn, of D. A. Gunn (Engineering) Ltd., who is one of the scheme's most enthusiastic supporters. In his company's factory at Acton, where some 80 employees are engaged on medium-heavy sub-contract work, there are four craft apprentices being trained under the group scheme.

In the factory itself, these boys are being trained in turning, milling, boring, drilling, welding, and profiling. Two have already paid visits to other firms in the group, gaining experience in sheet metal work and electrical engineering, while one apprentice from a sheet metal firm has spent a period with Gunns.

Biggest points in favour of the scheme, Mr. Gunn believes, are:
1—It has made it easier to attract good quality apprentices.
2—It frees him and his staff from the

routine details of organizing the training, while the supervisor's regular reports keep him completely *au fait* with the progress being made by apprentices.

3—It ensures the ultimate entry to the firm of well-qualified young engineers who possess a broad knowledge of their craft and who should be equipped to make a valuable contribution to the firm's expansion.

Smallest firm in the group is The Joyco Engineering Co. Ltd., of Hillingdon, where some 20 employees are engaged on making press tools, special purpose machines, jigs, and prototypes in a sub-contract capacity. They have one apprentice indentured under the scheme, and plan to take on another when this boy is half-way through his training. Looking ahead, they intend to continue this pattern: as one apprentice emerges as a craftsman, a second will be half-way through, and a third will be just beginning his training.

Early Exchange

Although the apprentice here only began his training last March, the group supervisor felt that this was a case in which an early exchange visit would be beneficial. So the lad spent two months, last summer, with the sheet metal firm of Adams Bros. and Burnley Ltd., of Harrow. This visit is calculated to prove of great value to the boy, for his parent company make a variety of tools for use with sheet metal.

The visit gave him an opportunity of seeing in action machines of the type made by his parent company, the conditions in which they are operated, and the sort of thing that is likely to go wrong when they are put into production. It was experience he could not have gained at Joyco.

The managing director, H. Cowderoy, has also found that one of the scheme's biggest assets is that it has relieved their former problem of obtaining boys. "Previously, parents were not keen to send their boys to a small firm where training facilities were bound to be restricted," he said. "Now, however, parents realise that a small firm participating in this scheme can give their boy as good a training as he would receive in a big organization—where competition for apprenticeships is often intense."

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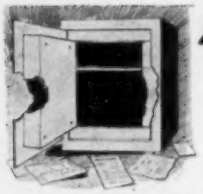

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CANTEEN EFFICIENCY

Continued from page 130

pressure, the operation taking approximately six minutes. By moving a control lever, the tea is then transferred into a steam-heated storage urn, where it can be retained at service temperature for several hours.

Since the tea has been separated from the leaf, the liquid does not continue to brew, and it retains its quality for over two hours. The transferring process takes about six minutes, and as soon as the operation has been completed, a further four gallons can be brewed. The equipment gives an hourly output of 16 gallons.

Models can be supplied with one or two storage urns having a capacity of four, six or eight gallons. Smaller models can also be supplied to make two gallons of tea at a brewing.

The equipment has an easy-to-clean chromium-plated exterior, but all metal parts which come into contact with the tea are made of (or plated with) pure silver to minimize the risk of tainting.

AUTOMATIC BREWER. No unnecessary frills are attached to the *Teamaka*, which got its first public showing at Olympia. It is a simple, workmanlike piece of equipment, made entirely in stainless steel, which boils the water, makes the tea automatically, stores it hot, and adds milk when serving into the cup.

The leaf is placed in an infuser at the top of a cylinder-type boiler. When the water boils, a controlled amount flows through the tea-leaves and the liquid beverage filters through into the storage container below.

The design ensures that unless the water is actually boiling it cannot pass into the tea infuser. The infusion is automatically controlled so that the maximum extract is obtained from the leaf without loss of flavour. Once the boiling water has passed through the leaves, they cannot again come into contact with the liquid. This enables the tea to be stored hot, in the container in which it is made, without becoming stewed. A special service valve gives tea with or without milk as required, without adjustment, at the rate of 60 cups in five minutes.

The *Teamaka* is available in three sizes: three gallons, five gallons, and eight gallons. Boiling time required for each is 40 minutes, 55 minutes, and 90 minutes respectively. It can be operated by gas or electricity.

'PROGRAMMED' MACHINE TOOLS

Continued from page 95

here, too, fundamental difficulties arise when attempts are made to produce simplified versions.

What, then, are the prospects for the smaller firm? One logical development will be the setting up of machine tool computing centres, similar n principle to the centralized toolmaking facilities which already exist. To these centres firms which want to introduce new products will send designs and drawing office information. In return they will receive either master parts (for use on ordinary copying machines) or magnetic tapes (if their circumstances justify the expense of installing one or more sets of control equipment).

Small firms may also benefit from the fact that it will be easier for large manufacturers to spread the manufacture of interchangeable parts over any number of sub-contractors. There is a chance that new-style copying work—using tapes prepared by firms with first-class development and design facilities—will become a specialized branch of the engineering industry.

But the "revolutionary" effects of machine tool programming will be softened by the speed at which the "revolution" takes place. Seldom has industry shown any inclination to precipitate grave crises by seizing new production methods before there is time for adjustments to be made!

To the machine tool industry—already extended by demands for standard equipment—the advent of numerical programming is a challenge. For attaching automatic control gear to machines originally designed for human operators is neither a logical nor a particularly efficient approach.

The next stage must be the development of machines designed specifically for numerical programming, with built-in gauging devices, and more efficient feeds. No longer will it be necessary to group all the controls at one point—or even to locate them at convenient working heights. Here is a chance for designers to break right away from traditional ideas!

Eventually it may lead to the development of a really universal machine tool, incorporating a number of different toolheads and capable of carrying out all standard machining operations in one set-up.

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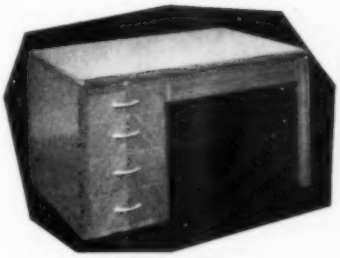

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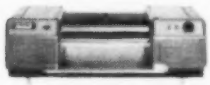

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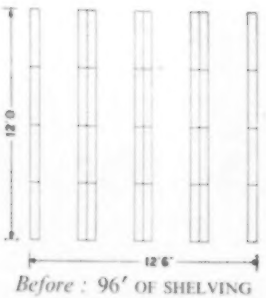

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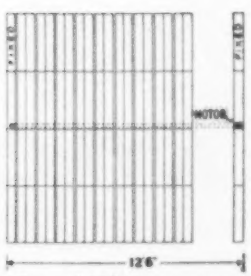

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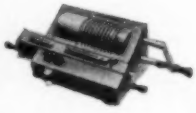

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